THE ENGINEER

A Seven-Day Journal

B.W.R.A. Fatigue Testing Laboratory

ON Monday last we attended the opening ceremony of the new fatigue testing laboratory at Abington Hall near Cambridge where is based one of the research establishments of the British Welding Research Association. The ceremony was performed by Lord Woolton, and afterwards some 300 members and guests of the association were able to view the many aspects of welding and weld fatigue with which this body is concerned. The pleasing style of this new building, which has a floor area of 5000 square feet, owes much to Professor Baker, it being the first building based upon his plastic design theory as applied to welded structures. So slender are its portal arches that the building resembles a thin, bricked wall shell. Other work in connection with this plastic theory is in progress at Abington. An important part of the researches of the Association is related to the fatigue of metals and particularly to the fatigue of complete structures. In this sphere its work had been limited previously to purely resonant investigations. It has now installed a Losenhausen machine, the largest in this country, on which unequal cyclic tensile and compressive forces can be applied. The machine is designed for dynamic loads of up to 100 tons in either tension or compression. There are four speeds, namely, 200, 300, 400 and 600 cycles per minute. The machine is also capable of applying static loads reaching 200 tons. Under axial loading, test pieces up to 6ft clear length can be accommodated, reaching 2¾in in thickness or diameter. The lower and stationary head of the machine incorporates a bending table on which beam tests may be carried out. For dynamic loading a pump unit generates pulsating pressures in the tension cylinder of the straining head. A compression cylinder in the head is connected with an oil vessel, which acts as an oil counter spring and which is maintained at a steady predetermined load. If, for example, the machine is required to test a specimen between limits of 5 tons compression and 50 tons tension, the fluctuating force in the tension cylinder is set to vary between 10 and 65 tons and a steady force of 15 tons is applied to the compression cylinder.

Export of Motor Vehicles

THE Minister of Supply, in a written reply on Monday, referred to the allocation of vehicles between the home and export markets. He stated that it had been agreed with the industry, in order to increase the export incentive, that the home quota instead of being a fixed figure should be made a proportion of the output, this proportion being 20 per cent passenger cars, 30 per cent light commercial vehicles and 50 per cent heavy commercial vehicles. Whilst these percentages would appreciably increase these home deliveries to an estimated 90,000 passenger cars and 77,000 commercial vehicles, the actual rate of deliveries would drop initially, as in fact the previous quota had been exceeded and deliveries had been as high as 110,000 a year. Despite the imposition of import cuts in Australia and New Zealand, the motor industry's two largest markets, the Society of Motor Manufacturers and Traders has announced that shipments in May last show that exports continue to run at a high level. The 32,145 cars sent overseas was in fact greater than the monthly average exports (30,728) last year, and the same comparison applies to shipments of commercial vehicles. The value of exports of cars shipped in May was more than £11¼ million, compared with a monthly average of just under £9¾ million last year. There has also been a recent increase in trade with Canada and the U.S.A.

Bevercotes Colliery

AT a ceremony on Thursday of last week, June 19th, the Minister of Fuel and Power, Mr. Geoffrey Lloyd, cut the first sod of a new colliery at Bevercotes, near Worksop, in the East Midlands Division of the National Coal Board. From a study of all available information the workable reserves of coal available in three major seams in an area of 12 square miles—of which Bevercotes is the centre—are estimated to be over 113,500,000 tons. In addition there are other deeper workable seams which require further provings before the full reserves available can be calculated. In the light of this information it was decided to proceed with the planning of a large modern colliery at Bevercotes. Two shafts are to be sunk, each of 24ft in finished diameter, and they will be lined throughout with reinforced concrete. The total depth to be sunk will be approximately 3000ft, but it is expected that the top hard coal seam will be reached at about 2420ft. The colliery has been designed to give an annual output of 1,250,000 tons of saleable coal, or approximately 5000 tons per working day. The present expectation is that by 1960 there will be a production of 1000 tons a week, output from that time rapidly advancing to the planned figure. The colliery is to be worked by longwall methods with power loading. Bevercotes is to be an "all-electric" colliery and its surface buildings will include pithead baths and canteen, medical treatment centre, workshops, stores and offices. A coal preparation plant, capable of dealing with the whole output, is to be erected and other works envisaged include a branch railway line about 3½ miles long, to connect with the existing line at Boughton. The anticipated capital cost of sinking and equipping the colliery is £5,500,000. Speaking at last Thursday's ceremony, the Minister of Fuel and Power said that the National Coal Board now had in hand the sinking of seven new collieries and the large-scale reconstruction of about eighty existing mines.

Oceanographic Research

THE R.R.S. "Discovery II" has completed the first of a series of cruises in the North Atlantic, during which the built-in wave recorder was tested. This recorder takes account of wave pressures through two small holes placed 10ft below the water line on each side of the ship, and records taken on board were compared with measurements made by fixed wave recorders on the coast and by apparatus put out from the ship. Results showed that the records were accurate within plus or minus 10 per cent. For the study of ship movement at various speeds and wavelengths, research on the formation and travel of waves is necessary, and for that purpose deep ocean wave records are essential. During the cruise, winds of gale force were encountered and waves, a third of which were higher than 20ft with the maximum being 34ft in height and 360ft in length, were associated with winds of 45 to 52 knots. When the force of the wind had decreased the waves diminished in height, but one-third were more than 22ft high. To separate the different wavelengths occurring in the wave pattern a wave analyser was used and results confirmed that the growth of the wave pattern is the development of the wave spectrum, the energy being concentrated in a dominant wavelength of increasing length as the wind increases in strength. The passage of water in waves, drift currents and tidal streams through the earth's magnetic field produces weak electric currents, and these were sampled by using towed electrodes. The principle, which was first discovered by Faraday, is useful for studying water movements, but is too complex to interpret for navigational use. During the voyage water temperatures were read and samples taken at varying depth. These will assist in the study of water circulation, and by analysis of the samples it is hoped to discover the factors influencing the biological productivity of the sea. New methods and instruments were tested, one of which records the underwater path of a net.

The World Power Conference

THE annual report of the World Power Conference for 1951 has been published this week. In its survey it records that during last year the German Federal Republic and Japan were admitted to membership. The report says that there are now forty member countries of the Conference, in thirty-seven of which national committees have been formed. The technical programme of the next World Power Conference—which is to be a sectional meeting held in Rio de Janeiro from July 25th to August 8, 1954—is included in the report. Preparations for British participation in that meeting have already begun, a papers committee under the chairmanship of Sir John Hacking, having been appointed. The International Executive Council of the Conference is to meet in Chicago on September 4th next, by invitation of the United States National Committee and of the "Centennial of Engineering Convocation, 1952," which is being organised by the American Society of Civil Engineers in association with other American engineering institutions. At the recent annual general meeting of the British National Committee, Sir John Hacking was elected to succeed Mr. Harold Hobson as vice-chairman, and Mr. F. G. Brewer was elected honorary treasurer in succession to Colonel C. M. Croft. Sir Vincent de Ferranti is chairman of the British National Committee and Dr. A. Parker honorary secretary.

Air Registration Board Report

THE fifteenth annual report of the Air Registration Board for the year ended March 31, 1952, was published last week. In presenting the report, Lord Brabazon of Tara made some early references to the extensive programmes of fatigue research in metals and structures which were in hand, particularly with some recent alloys. With regard to crash injury problems, he stated that the backward facing seat was not a panacea for all accidents and that in future the Board would attend all accident investigation inquiries. Both forward and rearward seating arrangements were being studied. Lord Brabazon then referred to the rather disappointing results from recent meetings of the International Civil Aviation Organisation (ICAO) with respect to airworthiness standards, and suggested that this body "would do well to re-examine its whole outlook on the airworthiness question." The report states that there were no major developments on the British civil airworthiness requirements. Some changes in legislation were noted in connection with radio equipment. Other sections of the report deal with the prototype investigations undertaken by the Board, including those on complete aircraft, power plants, instruments, radio installations, and the testing of air handling characteristics.

Harvesting of Brown Sub-Littoral Seaweeds

No. II—THE CONTINUOUS GRAPNEL METHOD*

By J. M. HAY, D.Sc., M.I.Mech.E., F.R.S.E.

(*Concluded from page 817, July 20th*)

Machinery is being devised for the commercial harvesting of British sub-littoral seaweeds. Two main principles are being investigated, namely, tearing the weed from the sea bed and raising it to the surface mechanically and cutting the weed from the sea bed and raising it by entrainment in water. The development of a unit operating on the former principle is described.†

Further Trials at First Belt Speed and Higher Boat Speeds

THE object of these tests was to determine the effect of increasing the boat speed relative to the conveyor belt speed; no attempt was at this time made to increase the belt speed. For the purpose of enabling comparisons to be made quickly, the experiments at the higher boat speeds were undertaken on weed beds of as nearly uniform density as could be judged by visual inspection. Owing, however, to the small size of the beds in question it was necessary to carry out the tests in four different areas round the islands of Kerrera and Shepherd's Hat; these areas will be referred to as (1) Shepherd's Hat, North Area—mixed bed of *L. cloustoni*—many of *cloustoni* plants carrying epiphytic growths of *L. digitata* (the bed on which original experiments were conducted); (2) Shepherd's Hat, West Area—almost pure *cloustoni* on rocky sea bed; (3) Slatrach Bay Area (west side of Kerrera)—mixed bed of *L. cloustoni* and *L. digitata*—substrata, rock and boulders; (4) Cutter Rock Area (east side of Kerrera, near south end of Sound of Kerrera)—weed growing mainly on large boulders. The nature of the weed beds and the substrata on which the plants grow, differed widely in these areas and provided a means of testing the equipment on different kinds of sea bed. It was thought at first that the presence of so many epiphytic growths on the bed in Shepherd's Hat Bay (Area 1) might be partly responsible for the apparently high harvesting efficiency obtained in the early tests; but this theory was disproved by the next series of trials carried out in Area 2, where the weed was pure *cloustoni*, and where the test giving the best performance for a single run at the lower belt speed was recorded, viz., 4¾ cwt weed collected, 2¾ cwt weed estimated lost (or a gross weight of weed brought to the surface of 7½ cwt) in 5½ minutes for a run of 49 yards. In Slatrach Bay (Area 3) a few large boulders were brought up with the weed, but this trouble was more pronounced at the bed in the Sound of Kerrera (Area 4), where almost every fifth plant was brought up attached to a boulder; one of these with four plants adhering to it was just under 120 lb in weight. Of the various tests in this series conducted in Areas 1, 2, 3 and 4, in which the run was approximately 45 yards and the time of run about 6¼ minutes, six in each area were selected as representative of harvesting over weed without visible gaps in the bed. The average performance did not differ greatly as between the various areas; they were as follows:—Area 1, 4·5 cwt gross, 3·6 cwt net; Area 2, 5·6 cwt gross, 3·8 cwt net; Area 3, 5·0 cwt gross, 3·9 cwt net; Area 4, 4·7 cwt gross, 3·7 cwt net. Within the probable limits of accuracy, the average for the four areas may be given as 5 cwt gross and 3¾ cwt net for the run of 45 yards in 6¼ minutes at a conveyor belt speed of 1·7ft per second and a boat speed of 0·357ft per second; the weed lost in stripping was 25 per cent of that brought to the surface.

Since no apparent falling off in the quantity of weed brought to the surface had occurred as a result of increasing the boat/belt speed ratio and since there had been a substantial increase in the net quantity of weed harvested in unit time, an attempt was made to increase the boat speed still further for the same belt speed. Tests were therefore carried out in areas 2 and 4, in which the time for the run of 45 yards was cut down to 4½ min. This period corresponds to about the maximum speed at which it was possible to operate the equipment in its initial form. However, from the tests for which reasonable accuracy can be claimed, the average figures for the series were as follows:—Weed brought to the surface, 4·9 cwt gross; net weed harvested, 3·1 cwt; time for run of 45 yards, 4·5 min; conveyor belt speed, 1·7ft per second; boat speed, 0·50ft per second. The best test in the series, conducted in area 2, yielded 5¾ cwt gross and 3¾ cwt net in 4½ min. The exceptional test of which mention has already been made was carried out at an intermediate speed and has not, therefore, been included in any of the recorded series. Subsequent tests at the same speed gave a gross yield of only around 5½ cwt for a similar run.

Table I—*Summary of Tests on Short-Hook Continuous Grapnel with Power Drive at Lowest Conveyor Belt Speed*

Maximum speed of conveyor belt used ... 1·7ft/sec
Average length of run per test ... ... 45 yards
Number of hook bars (various types)... ... 19

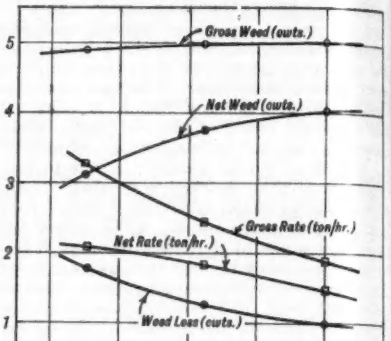
	Series A	Series B	Series C
Average time, min	8	6¼	4½
Mean boat speed, feet per second	0·28	0·36	0·50
Boat/belt speed ratio, per cent	16·5	21·2	29·4
Gross weed, cwt	5·0	5·0	4·9
Net weed, cwt	4·0	3·75	3·1
Weed lost, cwt...	1·0	1·25	1·8
Weed lost, per cent...	20	25	37
Gross weed, cwt per min... ...	0·62	0·80	1·09
Net weed, cwt per min	0·50	0·66	0·69
Gross weed harvested, yard run pound	12·4	12·4	12·2
Net weed harvested, yard run pound	9·9	9·3	7·7
Gross harvesting, rate tons per hour	1·88	2·40	3·27
Net harvesting, rate tons per hour	1·50	1·80	2·07
Gross weed harvested per square yards, pounds	28·8	28·8	28·3
Net weed harvested per square yards, pounds	22·9	21·7	17·9

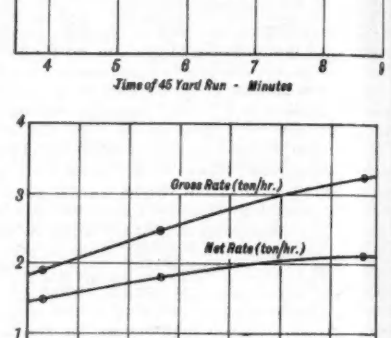
Summary of Results at Various Boat/Belt Speed Ratios

For purposes of comparison and ease of reference the mean results for the three series of trials on the mechanically driven prototype conducted at the lower belt speed of 1·7ft per second, are summarised in Table I above. The two graphs, Figs. 5 and 6, reproduced below indicate the effect of the boat speed on performance at the lowest belt speed. Table and graphs relate to results obtained from experiments conducted with the prototype in its original form before the equipment was modified to assist stripping.

Provision of Vertical Drop at Delivery End to Facilitate Stripping

The graphs, Figs 5 and 6, show clearly the serious disadvantage occasioned by the difficulty of stripping the weed from the hooks of the prototype continuous grapnel in its original form. It will be seen that the amount of weed lost in this manner increased so rapidly that the optimum net harvesting rate had, to all appearances, been reached at the relatively low boat speed of 0·5ft per second. From a purely practical point of view, however, it had become obvious that, in the circumstances, the maximum effective harvesting rate had been reached, and was limited by the ability of two men, exercising their utmost effort, to snatch the weed from the hooks during the very short interval of time when the conveyor belt was passing round about one-quarter of the circumference of the driving drum (about half a second).





FIGS. 5 AND 6—TESTS BEFORE MODIFICATION OF HARVESTER

Attempts were therefore made to design hooks from which the weed could more easily be detached at the delivery end of the belt. Unfortunately, it was found, as might reasonably have been anticipated, that harvesting effectiveness and ease of stripping were somewhat incompatible qualities. Plate hooks, hooks with smaller included angles and hooks spaced at greater distances apart on the hook bars were all tried; in each case stripping was easier, but this advantage, albeit a slight one, was gained at the expense of lowered harvesting efficiency. There was evidence that, amongst other influences, the centrifugal force imparted to the weed rounding the driving drum, although throwing the weed forward, tended at the same time to hold the plants tightly between the hooks,

* The previous article, No. I—"Assessment of the Problem and Review of Preliminary Experiments" appeared in our issues of May 30th, pages 718–720, and June 6th, pages 750–751.

† Patent applications have been submitted to cover the equipments described in this article.

so preventing them from falling to the platform. This suggested as a possible palliative the provision of a dwell in the transitional reversal of motion between the ascending and descending parts of the belt to allow time for the weed to fall from the hooks under the action of gravity.

This was provided by fitting an additional drum in such a manner that it was vertically above the original driving drum when the harvester was inclined at an angle of 45 deg. The centre distance between the new drum and the original driving drum was chosen arbitrarily as 2ft 6in. At the delivery end, therefore, the conveyor belt was constrained to pursue, in a downward direction, a straight path of similar length. For reasons of saving in weight and cost of equipment and of avoiding top-heaviness in a very light vessel such as that on which the gear was mounted, it was thought that, while a very much greater drop would have been desirable, this distance of 2ft 6in might, at least at the lower operating speeds, just allow time for the weed to fall clear of the hooks. One other point that should be mentioned in connection with the modification under discussion relates to the driving of the conveyor belt side chains which now had an arc of contact of only one-eighth of the circumference of the driving sprockets, and, in order to overcome this drawback in the new fitment, a double roller chain drive was provided between the two shafts so that the new drum should assist in driving the conveyor and the effective angle of contact was thus increased from about 45 deg. to slightly over 180 deg.

Resumption of Tests After Modification of Equipment

In the first set of tests undertaken with the equipment in its modified form, the conveyor belt speed was kept at its previous value of 1·7ft per second. No effort whatever was made to assist the stripping of the weed by hand, and it was immediately apparent that most of the weed brought up by the hooks was flung forward by virtue of its own inertia while passing over the upper drum, allowing it (whole plants or frond) to fall clear of the conveyor belt during its short downward motion over the stern platform. So few plants were carried back by the hooks into the sea that it was somewhat difficult to form a reliable estimate of the weight of weed lost in this manner. Over runs of 45 yards, when about 100 plants were brought to the surface, sometimes not more than three plants would be carried back into the water; at others, as many as seven plants were lost. Most of these earlier tests in this series (referred to as "Series D") took place on beds already partially denuded during previous trials, but while, mainly for this reason, the average gross weight of weed brought to the surface was less than in the preceding tests with the equipment in its original form, the difference between the net and gross weights of weed harvested did not in the aggregate exceed 5 or 6 per cent of the latter. In one of these tests at the original belt speed (1·7ft per second) and a boat speed of 0·5ft per second, when the total weight of weed harvested in a run of 45 yards was comparable with the average value found in previous tests, the net weight of weed was 4¼ cwt, and the estimated weight of weed lost was 22 lb (0·2 cwt); thus, the gross weight of weed was 4·95 cwt, and the percentage weed lost without manual assistance in stripping, was 4, against 37 per cent lost under comparable conditions before the equipment was modified, when two men were required to detach the weed from the hooks.

During the month of March, when these tests were made, the hooks tended to bring up a much greater proportion of frond than had been the case in earlier tests. This is accounted for by the fact that at this time of year the plants shed their old frond. Even under these conditions, however, about three-quarters of the total weight of weed harvested represented whole plants.

Testing at Increased Belt Speed Made Possible by Improvement in Stripping

Since the stripping process had now become more or less automatic, and the weed lost had been reduced to a reasonably small proportion of the quantity harvested, there appeared to be no further objection to raising the speed of the conveyor belt. The small pulley (3½in diameter) on the first countershaft was, therefore, replaced by a larger pulley (4½in diameter), thus increasing the maximum conveyor belt speed from 1·7ft per second to 2·1ft per second (23½ per cent increase). Although the conditions during

Fig. 7—Second Driving Drum with Conveyor Belt Removed

March and the beginning of April, when the initial trials were undertaken with the modified prototype harvester at this higher belt speed, differed somewhat from those pertaining during the earlier tests, sufficient information was obtained to enable a fair comparison to be made with the results of previous trials conducted at the lower belt speed before the equipment was altered to facilitate stripping. For the two reasons stated in the preceding paragraph, the gross weight of weed harvested during these experiments was generally less per 45 yards traversed than in earlier trials. Two sets of tests were made at the conveyor belt speed of 2·1ft per second, viz. (1) when the run of 45 yards was made in 4½ min (Series E), and (2) when a similar run was made in 3½ min (Series F). Owing to the sparseness of some of the beds traversed, the results of several tests had to be discarded, and, to obtain reasonable co-ordination, some discrimination had to be exercised in ensuring that the tests selected were carried out under conditions comparable to those made at the lower speed. Only about three tests in each series could be regarded as representative of conditions pertaining in earlier trials. The following Table II gives the results of the best tests in Series E and F, as well as the averages of ten selected tests in each. In order to enable a comparison to be made between previous tests and those carried out after the equipment was modified, the results from both have been plotted against the speed of the boat in the graph (Fig. 8) following the table.

Discussion: Results and Equipment

In the graph (Fig. 8) the improvement in the net harvesting rate, after a vertical drop at the delivery end of the grapnel conveyor belt had been provided for, is apparent; also there is, within the limitations of the experiments, no appreciable falling-off in the quantity of weed brought on board relative

Table II—*Results of Trials with Modified Power-Driven Model Conducted in Areas 3 and 4 in March and April, 1950*

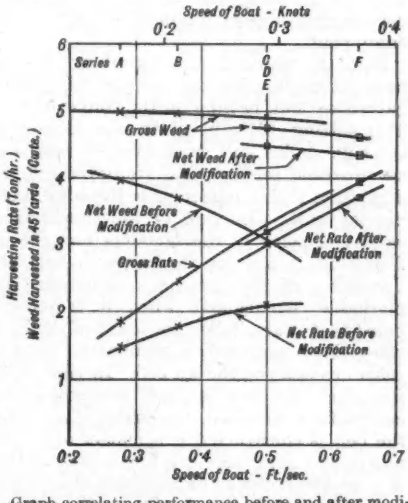
Maximum conveyor belt speed	2·1ft/sec
Average length of run	45 yards
Number of hook-bars (various)	21
Harvesting depth between, fathoms ...	1½ and 2½

Best Tests Made on Dense Bed

	Series E	Series F
Average time, min	4½	3½
Mean boat speed, feet per second ...	0·50	0·643
Boat/belt speed ratio, per cent ...	23·8	30·6
Gross weed, cwt	5·13	5·22
Net weed, cwt	4·9	4·95
Weed lost, cwt	0·23	0·27
Weed lost, per cent	4·5	5·2
Gross weed, cwt per minute	1·14	1·49
Net weed, cwt per minute	1·09	1·41
Gross weed, yard run, pound	12·8	13·0
Net weed per yard run, pounds ...	12·2	12·3
Gross rate, tons per hour...	3·42	4·47
Net rate, tons per hour	3·27	4·25
Gross weed per square yard, pounds	29·6	30·2
Net weed per square yard, pounds...	28·3	28·6

Averages of Ten Tests Made on Fairly Dense Beds

	Series E	Series F
Average time, minute	4½	3½
Mean boat speed, feet per second ...	0·50	0·643
Boat/belt speed ratio, per cent ...	23·8	30·6
Gross weed, cwt	4·75	4·62
Net weed, cwt	4·5	4·4
Weed lost, cwt	0·25	0·22
Weed lost, per cent	5·3	4·8
Gross weed, cwt per minute	1·05	1·32
Net weed, cwt per minute	1·10	1·25
Gross weed per yard run, pounds ...	11·8	11·5
Net weed per yard run, pounds ...	11·2	10·9
Gross rate, tons per hour...	3·16	3·96
Net rate, tons per hour	3·00	3·75
Gross weed per square yard, pounds	27·4	26·7
Net weed per square yard, pounds...	26·0	25·4



Graph correlating performance before and after modification drawn on speed of boat base. (Note: Conveyor belt speed in series A, B, C and D was 1·7ft/sec, while in E and F it was 2·1ft/sec.

Fig. 8—Performance after Addition of Second Driving Drum

to that raised to the surface by the hooks as the speeds increased. Before the addition of the second driving drum it had become fairly evident that two men could strip the hooks at a rate of little more than 2 tons per hour, and it is doubtful if this rate could have been maintained. After the equipment had been modified, one man only was required to give occasional assistance in the operation of stripping. In later experiments the provision of cylindrical extensions with projecting lugs on either side of the upper driving drum prevented weed catching on the shaft. If, in addition, some form of reinforcement is provided to avoid damage by stones, the adoption of the simple expedient employed in these later tests should result in efficient stripping without the need for any other mechanical device.

The circular arc form of hook was selected in the first instance because it was assumed that retractable hooks would ultimately be required to secure satisfactory stripping. There is therefore no reason to assume at this stage that it should not be possible to find a hook form more suited than the present one for use in conjunction with the method of stripping that has just been mentioned, and which, despite its great simplicity, has proved reasonably efficacious. After the speed of the conveyor belt had been raised from its initial value of 1·7ft per second to 2·1ft per second the frequency with which the hooks were bent back or distorted showed a tendency to increase. This was particularly noticeable in the case of a new batch of hooks made from a fresh consignment of ½in round mild steel bar, which was of a softer nature than the original material. This provides information that should be useful in the design of hooks capable of withstanding the normal forces involved in carrying out their functions without undue liability to deformation. The present hooks have proved barely strong enough to prevent distortion at belt speeds greater than 1·7ft per second, and, although the deformation that does occur is generally of such a nature that it can be easily and quickly rectified, some attention will have to be given to questions of design and of suitable materials for this component. While it is very desirable to retain as far as possible the present simplicity of the equipment, it may be found expedient to incorporate some form of springing of the hook bars similar in nature to the arrangement used in conjunction with the tines of agricultural harrows and cultivators. This would have the effect of lessening the risk of distortion and decreasing the shock strain on all parts of the equipment.

Similar reasonably satisfactory results have attended the use of the 14 S.W.G. galvanised link netting on the conveyor belt. This netting, 17¾in in width, was secured to the side chains and cross bars by means of seven-strand seizing wire. It never suffered damage of such a nature as to impede experimental work. In view of the considerable weight of some of the boulders brought up from time to time on the conveyor belt, the durability of the netting is somewhat remarkable, particularly when it is remembered that it also takes the brunt of the blow when the conveyor belt encounters rocks or other obstacles on the sea bed. In view of the fact that the belt is itself responsible for compacting the weed, the material of which the belt is constructed is a matter of significance, and it is therefore worth noting that this relatively flimsy link netting stood up so well, due largely, no doubt, to its extreme flexibility.

No claim is put forward in this report that the short-hook continuous grapnel system represents the complete solution of the baffling problem of the mechanical harvesting of underwater seaweed. The method was selected for experimental investigation as the one of two that appeared likely to yield positive results in the minimum time; the equipment required was simple and inexpensive, and yet, with the very small 30ft boats available, it gave promise of enabling sublittoral plants, such as *Laminaria cloustoni*—the largest useful indigenous variety—to be harvested at moderate depths. While the results obtained from the tests carried out with the small and lightly constructed prototype model appear to have justified these initial assumptions, it must be admitted that the experiments so far made, even with the present diminutive scale model, have been by no means exhaustive. Nevertheless, the usefulness, simplicity and effectiveness of the system have been demonstrated.

Trials in Orkney Waters

Although the substrata of the weed beds around the islands in the vicinity of Oban varied widely in character and included shingle, boulders, and solid rock of very irregular formation, it was deemed desirable that further experiments should be conducted in Orkney waters where one other kind of mechanical harvesting gear had failed to meet requirements.

Trials at Westray

What appeared to be a fairly dense bed of *Laminaria* was located on the east side of Papa Sound at a depth of about 2½ fathoms. The surface was too broken to enable the species of weed to be determined by observation from the boat, but, as this was not a matter of primary importance at the time, the harvesting gear was slung overboard and lowered to the sea bed, the engine started and the grapnel conveyor belt set in motion. Immediately large masses of weed, consisting mainly of *Laminaria saccharina* with a few plants of *L. digitata*, were brought to the surface. Five runs of about 35 yards each were made at successive points along the south-west shore of Papa Westray. With the *L. saccharina* and *digitata* a few large plants of *Saccorhiza bulbosa* were harvested, but no *L. cloustoni* was found in this area. The yield in this series of tests was around 3 cwt of mixed weed per run of 35 yards in 2½ min, corresponding to a harvesting rate of 3½ tons per hour. The runs were made against the tide, which, towards the end of the series, reached about 3 knots. Some assistance had to be given to detach the weed from the hooks owing to the entanglement of the long fronds on successive hook bars; this is unnecessary in the harvesting of *cloustoni*.

Nature of Sea Bed

An inspection of the sea bed on the west side of Papa Sound revealed that, instead of the sand, shingle and small boulders found on the east side of the Sound, the sea bed was a continuation of the rock formations sloping down from the adjoining shore on the Westray side. These rock formations are typical of many around the Orkney Islands in localities where *Laminaria cloustoni* is found. They consisted in this area mainly of hard sedimentary rocks with the strata varying from about 4in to 8in in thickness, inclined at angles between 25 deg. and 40 deg. to the horizontal. The outcropping edges of the strata formed irregular ridges with very abrupt, often vertical and sometimes re-entrant, faces where fracture of the strata had occurred. In many cases the ridges were several feet in height where cleavage had taken place through a number of adjoining layers of the strata simultaneously. Such ridges would constitute very formidable obstacles for many kinds of seaweed harvesters to negotiate. In the spaces between the ridges were strewn numerous slabs of broken strata of roughly diamond shape in plan; these added considerably to the other natural hazards encountered on the *cloustoni* beds. The nature of such a sea bed is exemplified by an incident that occurred at the end of one of the tests when it was found impossible to dislodge the lifeboat anchor by any form of humouring that could be employed. In the end resort was had to main force in an attempt to retrieve the anchor, but these efforts succeeded only in breaking the new 2½in rope by which it was secured, leaving the anchor itself firmly jammed amongst the rocks.

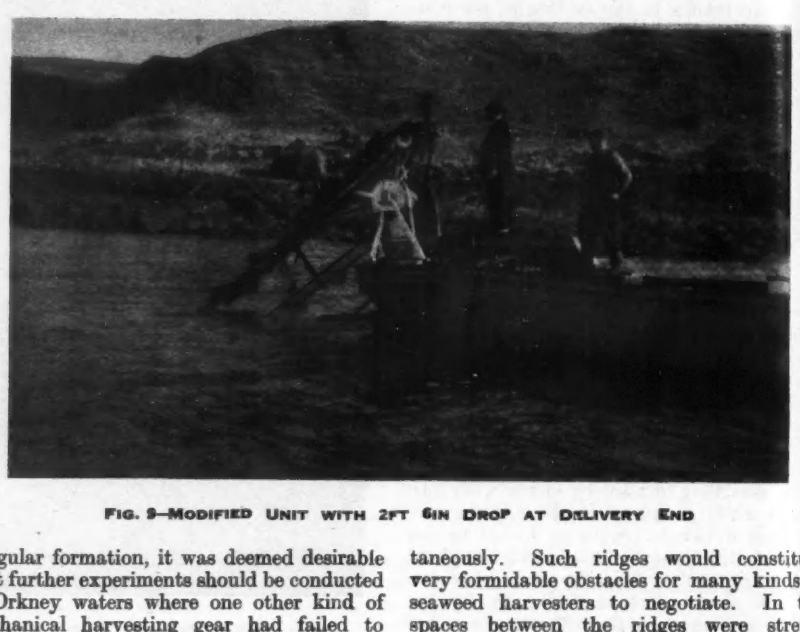


Fig. 9—Modified Unit with 2ft 6in Drop at Delivery End

Trials on Cloustoni Beds

During the two days that were devoted to trials of the equipment conducted on the west side of Papa Sound where the sea bed was of the nature described in the preceeding paragraph, it was possible for several series of tests to be made at different points along the north-east coast of Westray, where beds of *L. cloustoni* had been found. The first test in this series was carried out slightly to the north of Ouse Ness. Here five runs were made varying in length from 25 yards to 35 yards, according to circumstances dictated by wind and tide as well as by limitations of harvesting depth and the

proximity of shoals. In each of these runs the weed harvested consisted almost entirely of *cloustoni*, but was very disappointing in appearance and size compared with the much larger plants found at comparable depths in the vicinity of Oban. Runs were made at depths varying between 1¼ fathoms and 2½ fathoms, but in this locality the size remained fairly constant. No significant difference was observed either in size or density at those depths covered by the rather narrow range within the limitations of the equipment available; at 1¼ fathoms as at 2½ fathoms, the plants ranged in length of stipe between 2½ft and 3ft, and averaged about 2¾ lb in weight. The net weight of weed collected in the average run of 33 yards was about 2½ cwt in two minutes, corresponding to about 8·4 lb per yard run (about 19 lb per square yard), or to a harvesting rate of 3¾ tons per hour.

While exploring the sea bed in a northerly direction from Ouse Ness, eight successive test runs were made and a tendency was noted for the quality of the weed to improve progressively as far as Vere Point, beyond which the bed deteriorated. On the following day several trials comprising seven runs averaging 35 yards were made a little to the south of Vere Point, where, for the range of depth between 1¼ and 2½ fathoms, the weed density was the highest encountered in that area. The *laminaria* harvested during this series of trials consisted almost entirely of *cloustoni*, with stipe varying in length from 3ft to 5ft, the average length of stipe being about 4ft 3in, while the average weight of the plants was a little under 4 lb. The duration of the runs was around 2¼ min and the net weed harvested per run averaged 3·7 cwt, corresponding to about 11·8 lb per yard run (27·5 lb per square yard), or to a net harvesting rate of 4·93 tons per hour.

Further trials were carried out at the northern end of Stronsay, but the onset of very strong weather prevented tests being made at Sandy Island within the period of time allotted to the Orkney trials.

For purposes of comparison it may be noted that throughout the experimental harvesting operations conducted near Oban in May and June in the Ardencaple Bay area the average yield of *cloustoni* harvested by the continuous grapnel during runs of 45 yards made in three minutes was 6 cwt, representing a harvesting rate of 6 tons per hour. (The highest rate achieved in one run, when the boat speed was increased to cover 45 yards in two minutes, was 9 tons per hour.) The point of interest here is not that a greater harvesting rate was attained at Oban than at Westray, for it may well be that beds exist in other localities around the Orkney Islands of much greater density than those where the experiments were conducted, but that the number of plants harvested per square yard in Orkney was greater than that in Oban in the approximate ratio of 7 to 5. The smaller size of the Orkney plants as compared with those at Oban (which in one bed averaged 7 lb in weight) was thus largely compensated for by the greater number of plants found per unit area. The disadvantage of small plants from the harvesting point of view, when any method other than the grapnel type of equipment is used, is that a greater proportion of the weight is lost when severance of the stipe takes place at a constant distance above the sea bed.

Conclusions

(1) *The Short-Hook Continuous Grapnel Principle.*—Experiments carried out with the prototype model of the continuous grapnel have given proof of the practicability of the system as a method of harvesting mechanically certain kinds of sublittoral seaweed, particularly in the case of *Laminaria cloustoni*.

(2) *Compacting.*—The experiments have established the soundness of the compacting principle, making possible and effective the use of grapnel members comprising hooks of about 5in in height. The inclined belt was found to act satisfactorily as a long skid, enabling large obstacles and reefs to be surmounted without damage to the equipment.

(3) *Direction of Hooks.*—It has been shown by the trials that the system of operating the grapnel members in a direction on the sea bed opposite to that of the boat eliminates the danger of anchoring and enables relatively light hooks to be used. The incidental advantage of operating the hooks in this direction so that the harvested weed is brought to the surface lying on top of the conveyor belt was also demonstrated in the experiments by the fact that very little weed was lost during this process.

(4) *Harvesting Efficiency.*—At the highest conveyor belt speed (2·1ft per second) used in the tests and at a boat/belt speed ratio of 0·306 the mean gross harvesting rate was just under 4 tons per hour when operating in a dense bed of *L. cloustoni*. This corresponds to about 27 lb of weed collected per square yard of sea bed traversed, indicating that the harvesting efficiency factor is of a high order. At the same belt speed, but at a boat/belt speed ratio of 0·428, an average rate of harvesting of 6 tons per hour was attained at the dense beds around Ardencaple Bay. The highest rate of 9 tons per hour in the same area was achieved at a boat/belt speed ratio of 5·35.

(5) *Stripping.*—Stripping of the weed from the conveyor constituted a major difficulty until a vertical drop of 2ft 6in was provided at the delivery end (Fig. 9); after this modification, the stripping efficiency was raised to somewhere in the region of 94 per cent in the case of *L. cloustoni*. To render the equipment suitable for dealing with long-fronded plants the vertical drop would require to be 5ft and the pitch between hook bars would also have to be increased.

(6) *Slope of Conveyor Belt.*—Owing to the difficulty of finding weed beds of uniform depth sufficiently long to enable quantitative tests to be made on the effect of the angle of inclination of the grapnel conveyor belt, it was not possible to obtain data on this point. Judging from experience, however, the equipment appeared to operate most effectively between about 40 deg. and 50 deg.

(7) *Grapnel Members.*—From the point of view of harvesting efficiency observations made during tests indicated that 4½in radius hooks were almost as effective as 5in hooks, but 4in radius hooks were definitely less effective than 4½in hooks. With regard to the spacing of the hooks on the hook bars, little difference was noticeable in harvesting efficiency for pitches between 1¾in and 2½in; there was, however, a marked falling-off in efficiency when the pitch was increased to 3in. Stripping was more satisfactory with coarser than with finer pitches. The best all-round results were obtained with 5in radius hooks (90 deg. included angle) spaced at about 2½in pitch.

(8) *Speed and Width of Conveyor.*—At each belt speed used in the experiments with power drive, the harvesting rate improved as the boat/belt speed ratio increased, and the curves show that, owing to limitations imposed by the nature of the equipment, optimum conditions had not been attained at the highest ratio reached. It is possible that, by using better material for hooks and stronger side chains on the conveyor belt, the speed of the conveyor might be increased to, say, double the higher value used in the experiments; this would permit a boat speed of about 1¼ knots. It is doubtful if this value could be greatly exceeded in practice; such a low boat speed may give rise to difficulties in navigating the vessel during harvesting operations unless some special technique is developed to overcome this drawback. There is no reason to suppose that the width of the conveyor belt could not be increased to at least double that used in the prototype model with a proportionately greater harvesting rate.

(9) *Conclusions Based on the Orkney Trials.*—The *cloustoni* plants harvested in Orkney were (within the limitations of the equipment) smaller than the plants in the Oban area. At comparable conveyor and boat speeds the harvesting rates in Orkney were about four-fifths of those obtained at Oban. Better results would probably have been obtained if a longer model had been employed, but the trials did demonstrate beyond any doubt that the continuous grapnel could be used effectively in Orkney waters and that the nature of the sea bed around these islands does not present any insuperable difficulties in this system of harvesting.

(10) *Components of the Prototype Model.*—(*a*) The construction of the prototype model was admittedly haphazard; it was made up of whatever components were most readily available. The conveyor belt frame comprising a pair of 2in steel tubes as the main members, was only just adequate for its purpose, although for this reason it did provide flexibility requisite to allow the undercarriage to adjust itself to the changing contour of the sea bed. The same object could be achieved by other means with some sacrifice of simplicity.

(*b*) The belt drive, which was incorporated in the equipment purely on grounds of expediency, functioned sufficiently well for experimental purposes. To ensure transmission of the requisite torque frequent adjustment of the tensioning pulley was necessary as the belt stretched. If this system of transmission were to be used on a commercial harvester, a relatively broader and heavier belt would be required, and the belt shaft, with its fast and loose pulleys, would be replaced by a clutch. It is considered, however, that the purpose would be better served by some form of hydraulic coupling.

(*c*) It was found that the pressure between the wheels of the undercarriage and the sea bed was a matter of considerable importance. A marked improvement in the operation of the equipment resulted when buoyancy was added to the undercarriage by the use of amphibious pneumatic wheels and packing the lower drum and sleeves with cork, thereby reducing the total net pressure on the sea bed to 90 lb, or, say, 70 lb, per foot effective width of grapnel member.

(*d*) No direct measurements were made of the power required to drive the grapnel gear, and there is at present insufficient data to give precise figures on the point, but it would be reasonable to estimate the average power as 0·85 h.p. per 1ft per second speed of conveyor per 1ft effective width of grapnel member. The rated power of the engine would have about twice this value. This aspect of the problem will, however, require further investigation.

(*e*) In the construction of the prototype model only the more common materials (mainly mild steel) were used. The stationary components were protected by paint while the moving parts were kept well greased to minimise the chance of damage by corrosion. No serious deterioration was observed in any of the parts subject to immersion in salt

LOCKS OF THE AMSTERDAM-RHINE CANAL*

FIG. 5—LIFTING GATE PORTAL—BERNHARD LOCK

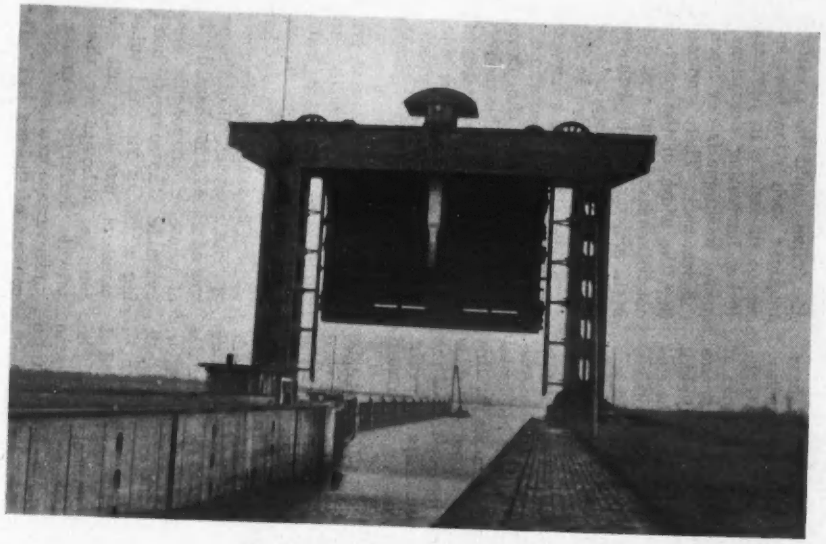


FIG. 6—LIFTING GATE—IRENE LOCK

FIG. 7—MOORING STRUCTURE—MARIJKE LOCK

FIG. 8—MARIJKE LOCK

water. Even the side chains and link netting of the conveyor belt have stood up well to the severe conditions involved. In a finalised form of the harvester, however, the use of corrosion-resistant materials might be advisable for some of the more highly stressed components.

(11) *Weather and Surface Conditions.*—Owing to the difficulty of handling the gear on one small boat by means of a derrick on another boat, most of the tests were carried out in relatively calm conditions or in an area where the wind was blowing offshore. Occasionally, experiments were made where there was a moderate ground swell, and sometimes when the surface was slightly choppy, without any very marked adverse effect on harvesting results. Severe "jabble" did, however, tend to dislodge some of the weed from the hooks at lower belt speeds. The indications are that at higher belt speeds the loss from this cause tended to decrease.

ACKNOWLEDGEMENT

The work described in this article forms part of the programme of research and development on seaweed undertaken by the Institute of Seaweed Research to whom the author is indebted for permission to publish.

The Amsterdam-Rhine Canal

No. II—(*Concluded from page 821, June 20th*)

Inland navigation in the Netherlands has been greatly improved by the opening of a new canal stretching from Amsterdam to the River Waal at Tiel. The canal is of generous dimensions and incorporates an entirely new section and the widening of an old canal over part of its length. Four locks have been built, the largest of which has an effective length of 350m and a width of 18m.

WHERE the Amsterdam–Rhine canal crosses the River Lek, two problems had to be solved. First, it was necessary to prevent silt entering the canal from the river, and, secondly, the depth of the crossing had to be maintained equal to that of the canal (i.e., about 1·5m deeper than the depth of the Lek at that point) without excessive dredging being required. The layout of the crossing was studied at the hydraulic laboratory of Delft University, and the design shown in Fig. 10 was evolved. It consists essentially of four training walls which direct the river flow into a comparatively narrow channel, and two manœuvring basins of approximately elliptical form. The flow of the river induces a current round each of the basins in the direction shown by the arrows, thus keeping the river flow separate from the canal. The river flow has an average speed of 80cm per second, but may increase to 150cm per second.

The river had already been provided with groynes to stabilise its course, several of which are shown in Fig. 10. The dredged depth of the river at the crossing is maintained from the groynes on both sides of the crossing and between the training walls. The side slopes shown in Fig. 10 and the bottom of the deepened channel between the training walls were protected with brushwood fascines below low water level, and with rubble above. The training walls each consist of two rows of steel sheet piles, filled in with sand and decked with a reinforced concrete frame, and are each about 3·5m wide and 50m long. The distance between the heads of the groynes in the Lek is about 135m, and the width of the crossing is about 275m. The distance across the river between the heads of the training walls is 85m at the upstream side of the crossing, and 109m at the downstream. Each one of the training walls will have a navigation tower at the end of it, from which all the vessels using the crossing will be directed. Such direction will be essential as the training walls will be submerged at times of high water. As they are, silting occurs in the crossing at the lowest river flows, but there is a scouring effect at higher flows which counteracts it. The flood dykes of the Lek may be observed in the diagram, showing the area inundated at high river flows.

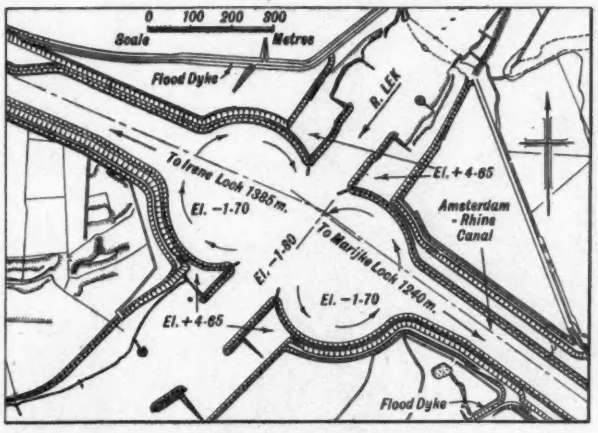


FIG. 10—RIVER LEK CROSSING

THE LOCKS

As already explained, the two principal locks are at Tiel (the Bernhard lock) and at Wijk bij Duurstede (Irene lock). Each of these two locks has an effective length of 350m, and a width of 18m. They are thus able to accommodate the largest trains of barges without interruption caused by rearranging the train. The Irene lock has three lifting gates which divide it into two equal parts; one of them is shown in Fig. 6. The difference in water level across the lock varies from an average of about 1·4m to a maximum of about 8½m.

The Bernhard lock has a lifting gate facing the River Waal, the portal of which may be seen in Fig. 5, with three pairs of mitre gates below it. It can thus be divided into compartments of 90m, 170m and 90m. Thus, lengths of 90m, 170m, 260m and 350m can be obtained; with one gate out of action, a length of 260m can still be obtained, which is capable of taking 80 per cent of the tows without interruption. The longest tows can be locked through without interruption in a lock chamber of 350m. The change in level across the lock varies from about 1·5m to about 5m. However, the design of all the locks has been based on the variation of level of the different sections of the canal given earlier in this article.

The Beatrix lock, which gives access to the River Lek for vessels travelling westward is very similar to the Marijke lock. The Marijke lock, as explained earlier, will be in use for only a very limited period each year, when the head across it will be up to 2·5m. It has an effective length of 225m, with two pairs of mitre gates, and is shown in Fig. 8. A pumping station has been built as part of the lock, to pump rain water and locking water out of the Betuwepand section, when the lock is functioning.

The design of all the locks follows similar lines, and they can be filled or emptied in six to ten minutes through sluices in the lock gates. The description below is of the Bernhard lock at Tiel, and is typical of the other three locks.

BERNHARD LOCK

The Bernhard lock is approached from the River Waal through a navigation basin similar in form and function to the two elliptical basins at the Lek crossing. Its general layout is shown in Fig. 9. Moorings are provided immediately above and below the lock, consisting of caissons in the canal bed at centres of 20m, with prestressed concrete beams spanning between them above the highest water level, for a total length of 500m, as shown in Fig. 9, and with floating stagings between them at water level. Similar moorings are provided at the other locks, those at the Marijke lock being shown in Fig. 7. The lock itself has an array of mooring rings, loudspeakers, signal lights, and so on, to facilitate the passage of vessels through it.

The lock gates can be opened or closed in sixty to ninety seconds; they are operated by

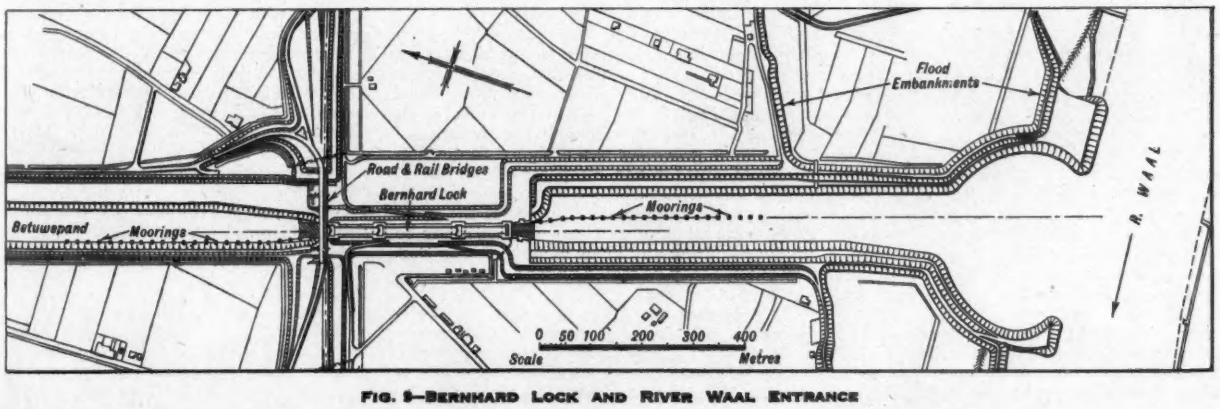


FIG. 9—BERNHARD LOCK AND RIVER WAAL ENTRANCE

electric motors. There are three sluices in each mitre gate, and six in the lifting gate, each operated by a separate motor to flood the chambers, the water passing through "turbulence chambers" in the gates, containing timber baffles, so that vessels in the lock are not disturbed or endangered by the incoming water. The speed of opening or closing the valves is regulated according to the size of lock chamber in use; they are controlled by 5 h.p., d.c. motors with Ward-Leonard controls.

The mitre gates are of steel construction, with a granite faced hollow quoin and a cast steel sill. The lifting gate is also of steel and is controlled by electrically operated hoisting gear situated in the massive reinforced concrete portal shown in the sectional illustration of the lock (Fig. 11). The gate is provided with wheels on pivoted brackets so that it is moved forward slightly, clear of its seating, before it is lifted. These wheels travel in a vertical

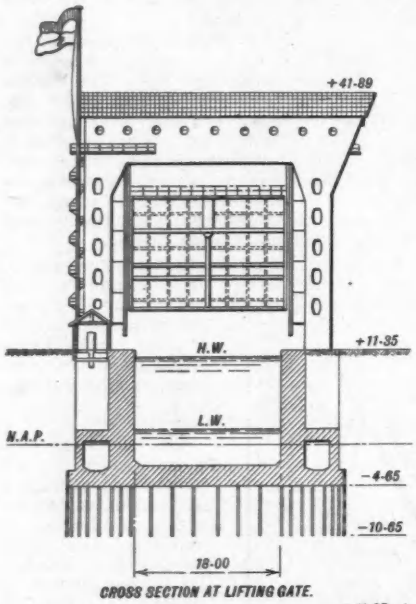


FIG. 11—BERNHARD LOCK

groove, running up the wall of the lock, on a steel bearing path. Heating elements are incorporated along this path, to keep it free from ice in cold weather. The sealing strip on which the gate rests in the closed position is of greenheart, and a steel rail along the invert of the lock forms the seal there. The gate weighs 198 tons and the counterweights weigh 184 tons in addition.

Construction of the lock involved the extensive use of dewatering plant and heavy earthworks for the relocation of a railway and a highway. At the site, peaty clay between 2·5m and 5m deep was underlain by sand interspersed with clay layers.

After the road and rail diversion works were sufficiently advanced, excavation of the lock was started. Pump wells were sunk to a depth of −20m N.A.P., a centrifugal pump with a capacity of 70 to 100 cubic metres per hour being immersed in the bottom of each well. Some of these pumps were of British manufacture. The ground water level was generally about +3·75m.

A row of eleven pumps was first installed on the east side of the works, and the excavation taken down to +0·7m. A second row of wells was then added close to the first in the bottom of the excavation to enable further excavation to continue at greater depth, and the first row was extended along the length of the lock. A third row of wells was installed at the west side of the site at the higher level to complete the dewatering. The ground water was thus lowered to a level of −5m and was noticeably lowered for a radius of 1¼km round the site. In the first part of the work, a total of fifty-six wells was installed, giving a peak yield of 2000 litres per second.

Additional pumps were placed in the discharge channels connecting the wells, to pump the water over the dyke into the Waal, and a venturi weir was provided to measure the flow. The lines of pumps were extended to the full length required as further progress on the rail and road relocation permitted. Excavation was generally carried out by a chain bucket excavator; the clay was used to form the dykes at the Waal basin, and the sand was stored for back-filling and for concreting. The site of the lock was thus completely excavated with battered slopes at each side, and when the lock walls were built, the space outside them was back-filled.

The lock is founded upon reinforced concrete piles, each 0·35m by 0·35m in cross section, and generally 6m in length. The piles were cast at a yard beside the lock site, the casting being carried out in three layers with clay paste between the piles and oiled paper between the layers. A travelling cableway spanned the lock, and was used to handle the piles, and later reinforcing steel, and to carry out a limited amount of concreting. The piles were driven with two piling frames of Dutch manufacture, which, with semi-automatic steam hammers and water jetting, were able to drive about forty piles in a working day of eight and a half hours. The piles were not built into the lock floor. Raking piles were driven to take the horizontal loads from the inner gates.

The reinforcing steel for the concreting was obtainable only in rather short lengths, and a butt welding machine was, therefore, used on the site for joining the bars; an electric cutting machine was also used. The lock was concreted in four stages—first, the lock floor was cast, and then the walls of the two culverts shown in the cross section, Fig. 11. These two culverts are not required for the functioning of the lock, but are to permit the flow of a supply of fresh water through the canal to various waterways as far as Amsterdam. The walls of the culverts were built with travelling formwork. The roofs of the culverts were then cast and the upper parts of the lock walls were again cast with travelling formwork. Expansion joints were left at centres of 16m in a longitudinal direction, and were made watertight by caulking with tar-impregnated rope.

The first three lifts were concreted from a travelling gantry spanning the lock, with concrete hoppers in it, and chutes below them to emplace the concrete. The concrete mix contained 340 kg of cement per cubic metre. A mobile mixing plant with two 1000 litre mixers supplied concrete to the gantry, and for the large pours of 450 to 1800 cubic metres each, a rate of 45 cubic metres per hour was achieved. The total volume of concrete in the lock is about 60,000 cubic metres.

The caissons forming the moorings at each end of the lock were built of reinforced concrete with steel cutting edges, and were sunk by excavating inside them with a grab. In the upstream mooring basin steel sheet piling has been driven along the banks adjacent to the lock to prevent any scour by passing vessels.

Two sets of mitre gates were assembled on the lock bottom as construction progressed. When they were in position the new dykes from the lock to the River Waal were tested by filling the basin enclosed by them and by the temporary dyke blocking the river, to a level of +10·5m, and leaving for three weeks. When this test proved satisfactory, the temporary dyke was cut away to give permanent access to the Waal. The remaining pair of mitre gates and the lifting gate were then floated into the lock and stepped into position.

The Amsterdam–Rhine canal has been built by various Dutch contracting firms, under the direction of Rijkswaterstaat Directie of Utrecht. The chief engineer of this body is Ir. B. A. Gelders, to whom our acknowledgments are due for his co-operation with this article.

Institution of Civil Engineers Conversazione

ON Thursday, June 19th, the Institution of Civil Engineers held its annual conversazione, which this year had been arranged to take place during the week of the colonial engineering conference. The corporate members and their ladies were received by Mr. Quartermaine, president of the Institution, and Mrs. Quartermaine, and the evening's events included recitals of light music and of piano music. As is usual at this function there was a display of models in the library, exhibiting various engineering works or researches. We include below some notes describing those amongst the models which appeared to be of greater technical interest and which, generally, were not concerned with works which have already been described in these columns.

Wave Generator and Wave Recorder.—This exhibit consisted of a water tank which represented a small section of a model coastline. A wave generator produced a series of waves of variable mixed frequencies in the model; an electronic apparatus measured the waves.

The wave generator was designed to develop a train of mixed waves, composed of two fundamental frequencies, either of which could be varied over a wide range. By use of the wave generator a wide range of wave periods may be produced during any given experiment, so that any scheme may be tested under all likely wave conditions.

A phenomenon which is sometimes overlooked is the effect of a train of mixed waves on a structure. Designs are often based on the action of locally generated storm waves, or of swell, each being considered separately. The worst conditions, however, are frequently found when local storm waves are superimposed on swell from more distant storms. It is difficult to predict the effect of such a disturbance. The use of the new wave generator will enable such conditions to be studied in models.

The wave recorder was designed to measure very small waves on inland lakes and reservoirs for specialised research, but was found to fulfil harbour model requirements exactly, and the instrument demonstrated was a miniature harbour model. It consisted of a valve oscillator, of which part of the tuned circuit was a vertical wire through the water surface. Rise and fall of the water surface caused variation of the frequency of oscillation, which was detected by the recorder and made visible either by an oscilloscope or on recording paper.

A Hydrograph Recorder.—An instrument producing continuous channel hydrographs of run-off from rainfall data, based on the similarity between slip flow and flood development in natural channels, was exhibited. Methods of dealing with long-term hydrographs are essential to give a true account of rainfall, the effect of which persists for weeks and even months. The instrument exhibited offers a solution to this problem.

A new mathematical approach produced a differential equation for stream flow, which was recognisable as a form that applies also to heat flow and other physical phenomena. This led to the development of the essential part of the instrument, which is a heat flow/heat storage device. A corresponding impulse of heat input in unit time may be adjusted to produce a unit

output temperature curve of a form following the unit hydrograph of the drainage basin in question, so that the essential device is virtually a thermo-electric model of the catchment area.

The apparatus can be used in a limited sense as a predictor over short periods under critical flood conditions, but principally as a foundation for the study of the hydrograph, and in particular in dealing with long-term cycles of rainfall, ground water flows, infiltration, and evaporation; it assists in solving the highly important problem in hydrology of obtaining a right proportion between the rainfall contributing to channel flow and that retained by the ground.

A Structural Model.—The several models of engineering structures exhibited included one showing the principal features of a new constructional shop at Stockton-on-Tees for the Power Gas Corporation, Ltd. This model, which was constructed mainly of "Meccano," was built to a scale of approximately ¼in=1ft. The shop consists of four transverse bays, each 85ft 6in span and 250ft long, bounded at each end by a longitudinal 70ft span. In all six bays overhead electric cranes of various capacities are provided. The height of the crane rails in the transverse bays is 30ft and in the longitudinal bays 50ft. The cranes in the longitudinal bays are of 50 tons capacity. The new shop is built entirely in structural steelwork and the roofs are covered with R.P.M. sheeting. All the columns rest upon reinforced concrete piled foundations.

Unusual structural arrangements were used for the building. In the transverse bays the second and fourth rows of columns were tapered and designed as vertical cantilevers, whereas the first, third and fifth rows of columns were hinged and designed to take only vertical reactions and small lateral forces. By these means the crane surge forces were taken down the second and fourth rows of columns. In the longitudinal bays, which were about 75ft high to the ridge, the roof members consisted of simple joist rafters spanning from ridge to eaves. The unbalanced horizontal forces tending to open the span were resisted by latticed girders in the planes of the roof slopes; these girders spanned 85ft 6in corresponding to the placing of the transverse bays.

The general result of this unusual design is a clean open structural form, with an estimated saving in weight of steel of about 10 per cent. In addition, rolled sections have been used extensively with welding, and it is stated that the total cost has been very much lower than it would have been with more familiar forms of structure.

A Forging Hammer Foundation.—The two models showed an 8-ton tup open forging hammer, which in design had had all its forces and vibrations calculated, it is stated, to an accuracy within 10 per cent. The hammer itself is always exactly located on the anvil, through the foundation.

In the prototype there are two concrete inertia blocks, the lower for reducing the enormous live loads into the ground by about 95 per cent, and the other to control hammer liveliness and reduce its maintenance. Rubber springs are placed between the two blocks and also under the anvil, without altering the blow force, and there are steel helical springs under the main lower block. Friction dampers bring the whole installation to rest in time for each succeeding blow. The system has more than twenty-four natural frequencies, with those of the ground and outer foundation. Oscillation, shock and stress wave mechanics were all calculated.

The prestressed concrete blocks prevent any tensile stresses, so increasing fatigue life, and form a fully three-dimensionally stressed structure. The aggregate was packed in place at the same time as the steel reinforcement, cables, cooling pipes, holding bolts, &c., and then grouted under controlled pressure, to make high-quality concrete with no construction joints. The holding bolts are also stressed to prevent fatigue.

Hangars at London Airport.—The hangars demonstrated by this model were the result of competitive tenders called for by the Ministry of Civil Aviation on behalf of British European Airways. General outlines and conditions were specified by the Ministry, but design and materials were left to the competitors. The successful scheme was a combination of normal reinforced concrete and end-anchored and fully bonded prestressed concrete.

The finished work, which is one of the largest contracts on which prestressed concrete has been extensively used, consists of two series of five main hangars, each 180ft and 110ft wide, with ancillary buildings along the length, joined at the north end by a workshop and stores block, 465ft long and 100ft wide.

The hangars are roofed by a series of concrete "T" sections, 4in thick, prestressed together on the ground by Freyssinet cables to form beams weighing 26 tons each, which are then lifted into position. They are carried at the front on hollow prestressed concrete beams which span 150ft clear across the main openings.

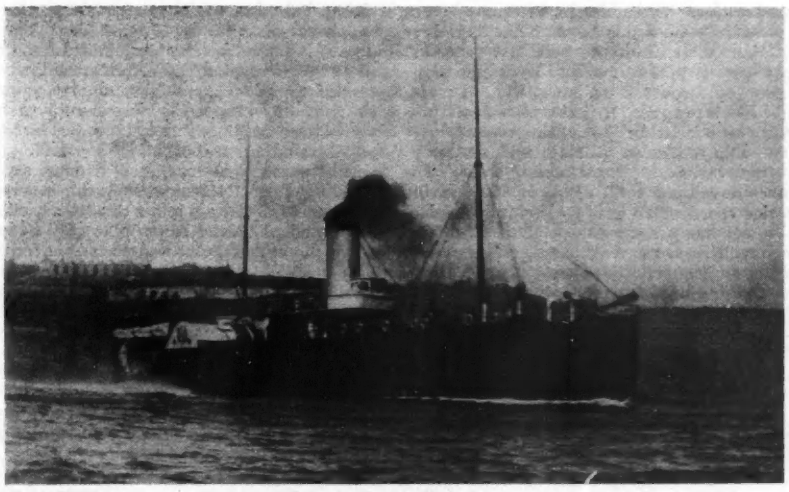
The roof of the north block is carried by a series of "I" section pretensioned, prestressed concrete beams of 50ft and 40ft span, while the floors and roof of the ancillary buildings are supported by a series of rectangular beams which act monolithically with cast in situ reinforced concrete slabs. The columns and walls of the buildings are in normal reinforced concrete.

Cross Channel Steamship "Lord Warden"

By G. W. TRIPP, O.B.E., F.C.G.I., M.I.C.E.

The service operated by British Railways for the carriage of motor-cars between Britain and France has been augmented by the completion of the "Lord Warden," which has a capacity of 120 cars. There is accommodation for 1000 passengers and the ship, which has a length between perpendiculars of 338ft, is powered by two sets of double reduction geared turbines of 8000 s.h.p., and will ply between Dover and Boulogne.

"LORD WARDEN" is no new name for a vessel plying the Straits of Dover, for as long ago as 1847 the South-Eastern and Continental Steam Packet Company placed on service a steamer of that name. She was built by Laird Bros. and had the following principal dimensions:—Length, 168ft; beam, 23·3ft; depth, 11ft; tonnage, 307 gross. She was driven by side lever engines, built by Forrester, of Liverpool, with two cylinders of a diameter of 42in with a stroke of 42in, and at a boiler pressure of 17 lb per square inch she attained a speed of 12 knots. As railways at that time were precluded from owning steamers, the directors of the then South-Eastern Railway formed this separate company, but in 1862 legislation removed this barrier and the steamers became railway owned. "Lord Warden" was reboilered in 1867 and went to the breakers in 1883.



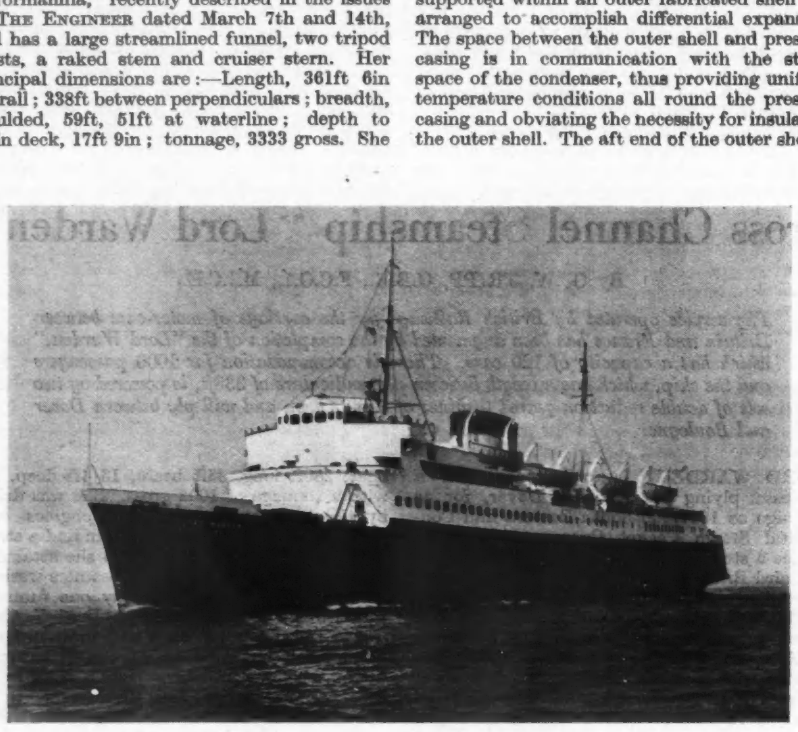
THE "LORD WARDEN" OF 1896

In those early days the bulk of the Continental traffic went by way of Folkestone and Boulogne, but when the London, Chatham and Dover Railway, the much-maligned railway which was perhaps the most progressive in the way of steamers, secured the contract for the carriage of mails between Dover and Calais, the position was reversed, and this route became the most popular. In 1896 the second "Lord Warden" came from the yard of W. Denny & Bros. Ltd., to join the fleet of the "Chatham" Railway, and with her two sisters, "Dover" and "Calais," proved a valuable addition to the company's steamers. As seen in the illustration, "Lord Warden" was a good-looking paddle boat, 280ft long, 35ft beam, 13·4ft deep, and with a tonnage of 1002 gross. She was driven by triple-expansion diagonal engines with cylinders 35·5in, 52·5in and 76in and a stroke of 72in. With an i.h.p. of 4084 she attained a speed of 19·65 knots. These steamers were the first of the type to have only one funnel, a practice now much in favour. "Lord Warden" was a very popular ship and reputed to be economical, but in 1911, at the early age of fifteen, she was sold to a Dutch firm of shipbreakers, her early demise being due to the advent of the turbine.

The new "Lord Warden," the subject of this article, was also built by W. Denny & Bros. Ltd., and is intended for carrying motor-cars to the Continent by the short sea routes; but she is also a modern passenger cross-Channel steamer with accommodation for 1000 passengers and a crew of seventy-seven. She will operate from Dover and will augment the services already performed by "Autocarrier" and "Dinard," which between them can take ninety-four cars, whereas the new vessel can accommodate 120 cars. There are folding steel doors at the stern, and when they are opened the cars can drive direct on board at all states of the tide, over loading ramps provided at the new terminals at Dover and Boulogne, and later at Calais. The turntable at the forward end of the motor-car deck enables cars, when embarking, to be driven along one side of the ship, turn and return along the other side and so be facing aft and ready to drive off again on reaching their destination. The clear deck

height of 10ft 6in will enable motor coaches to be carried, and at the after end the promenade deck has been left open, thus enabling a number of double-deck buses to be carried also.

As will be seen from the illustration, she is a modern vessel very similar in lines to the "Normannia," recently described in the issues of THE ENGINEER dated March 7th and 14th, and has a large streamlined funnel, two tripod masts, a raked stem and cruiser stern. Her principal dimensions are:—Length, 361ft 6in overall; 338ft between perpendiculars; breadth, moulded, 59ft, 51ft at waterline; depth to main deck, 17ft 9in; tonnage, 3333 gross. She

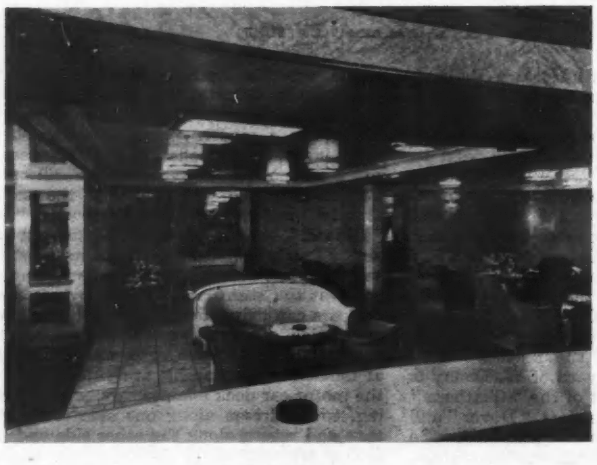


S.S. "LORD WARDEN" OF 1952

is fitted with a bow rudder for steaming astern and entering the loading bays. This, as well as the main rudder, is of the balanced type and operated by twin motor electro-hydraulic steering gear by Brown Bros, & Co. Ltd. of Edinburgh. She is propelled by twin screws, each propelling unit consisting of an all-impulse turbine, with double reduction gearing, still somewhat of an innovation on cross-Channel ships. The turbines develop a total s.h.p. of 8000, giving a service speed of 20 knots when fully loaded. The vessel has an astern speed of 16 knots. The propellers are three bladed, solid and of manganese bronze, and they turn outboard when running ahead. They were supplied by J. Stone and Co., Ltd., and have a diameter of 9ft 3in and a mean effective pitch of 9ft 3in.

The main machinery consists of two sets of Pametrada design geared turbines, manufactured by W. Denny & Bros., Ltd., running at 270 r.p.m. Each set is a single impulse turbine, driving the propeller shafting through a locked train articulated double reduction gearing. The astern turbines are incorporated in the same casing, their power being sufficient to give 85 per cent of the ahead revolutions. The nozzles and diaphragms of each turbine are carried in a single pressure casing of cast steel, supported within an outer fabricated shell and arranged to accomplish differential expansion. The space between the outer shell and pressure casing is in communication with the steam space of the condenser, thus providing uniform temperature conditions all round the pressure casing and obviating the necessity for insulating the outer shell. The aft end of the outer shell is rigidly bolted to the gearcase, and the forward end is carried on a suitable seating. The condenser is bolted to the lower half of the outer shell. The turbine rotors are machined from single forgings and are stiff enough to ensure that the first critical speed is more than 30 per cent above the maximum running speed. The blading and shrouding are of stainless steel. Each nozzle passage is machined from a separate nozzle segment, the nozzles being secured by rivets and interlocked joints to a steel centre and connected at the outer periphery by strap and dowel pins. The nozzle segments are of stainless iron. Each rotor drives its primary pinion through a fine-tooth flexible coupling, this pinion engaging with two primary wheels coupled to secondary pinions through quill shafts having flexible couplings at their after ends, the primary and secondary pinions being of nickel steel. The primary and secondary wheels have cast iron centres with shrunk-on forged steel rims, and are secured to tempered shafts. The primary gearcase is of cast iron and the secondary of fabricated steel plate. The thrust blocks are of the Michell line contact pattern, with six ahead and six astern pads, and are incorporated in the gearcases. The main shafting bearings are of Cooper Roller split design. The tailshafts run in oil-filled stern tubes, whose bushes are lined with white metal. "Newark" oil glands, supplied by Ferguson Bros., Ltd., are fitted at the outboard ends of the stern tubes. The main engine manœuvring valves are of Cockburn make, as also are the emergency shut-off valves fitted between the boilers and manœuvring valves, the self-closing governing valves between manœuvring valves and turbines, and the cross connection valve. The manœuvring valves, which are of superbalanced design with cast steel bodies, stainless steel spindles and nickel alloy valves and seats, have separate hand wheel control for ahead and astern valves, with a leak-off and drain valve incorporated in each astern valve. The emergency valves between the boilers and manœuvring valves are arranged to close automatically in the event of low vacuum conditions, and can also be operated by hand lever control from the starting platform, while the governing valves are arranged to close automatically in the event of overspeed, undue axial clearance, or loss of lubricating oil pressure. The arrangement of emergency "shut-offs" is designed to allow astern steam to be available to bring the turbines quickly to rest in the event of loss of lubricating oil pressure. Electric motor-driven turning gear is fitted to each main engine.

Steam is supplied by two Babcock and Wilcox integral furnace boilers (built by Denny Bros.) at 350 lb per square inch pressure and 650 deg. Fah. temperature at the superheater outlet. Each boiler has a normal evaporation of 40,000 lb per hour, a furnace volume of 400 cubic feet, and a total heating surface of 4275 square feet, including 245 square feet superheater heating surface. The boilers burn oil fuel with a closed stokehold system of forced draught and each is fitted with four oil fuel burners. The boilers are arranged fore and aft and "cross cornered" in the boiler room, to give a narrow uptake casing at the main deck. This arrangement requires a longer boiler room than if the boilers were installed side by side, but the narrow casing allows three rows of cars to be carried each side of it instead of only two. Advantage has been taken of the layout to arrange a central gauge board, where all gauges, &c., for both boilers can be seen from the working position of each boiler. The forced draught fans can also be controlled from this central position. The oil burning equipment has been supplied by J. I. Thornycroft and Co. and consists of a unit comprising two electric motor-driven 7500 lb per hour Drysdale "Horsoil" rotary gear wheel pumps, two heaters, two "Auto-Klean" discharge strainers and a duplex suction strainer. The latest pattern of Thornycroft oil sprayers and furnace front units are installed. The lighting up unit, supplied by White's Marine Engineering Company, consists of one



TEA LOUNGE

RESTAURANT

electric-motor-driven Hamworthy pump, a three-section, twelve-element electric heater and suction and discharge strainers, and can deliver 500 lb of fuel per hour at 200 deg. Fah., thereby ensuring rapid steam raising. Weir's "Robot" feed regulators are fitted, while, in addition to Klinger double-plate water level gauges, "Igema" distant-reading gauges are provided. The safety valves, full-bore type with silencers, and self-closing main boiler stop valves, have been supplied by Cockburns, Ltd. Six soot blowers are fitted to each boiler, two of single-nozzle retractable design, by Clyde Blowers, Ltd., and four "Diamond" multiple-nozzle design, by Babcock and Wilcox, Ltd. Air to the boiler room is supplied by two W. H. Allen geared turbo-driven forced draught fans, running at 1360 r.p.m., having a capacity of 23,000 cubic feet of air per minute at 7½in water gauge. Air trunking is fitted in the boiler room to ensure uniform distribution and temperature conditions. An electric motor-driven fan, supplied by Thermotank Ltd., is fitted for air supply when lighting up and when under standby conditions.

For domestic steam supply a Spanner "Swirlyflo" boiler has been installed, having an evaporation of 2350 lb per hour and a working pressure of 60 lb per square inch. The boiler is fired by a Laidlaw Drew fully automatic motor-driven oil fuel unit. The fan for the unit has a separate supply trunk to atmosphere to ensure constant air conditions, irrespective of the air pressure in the boiler room. A Weir motor-driven feed pump is fitted and works in conjunction with a Laidlaw-Drew feed water regulator.

An evaporator and a distiller, both supplied by G. and J. Weir, Ltd., have been installed to produce make-up feed for the boilers, the capacity of each being 30 tons in twenty-four hours. The evaporator, which has a fresh water supply, has a heating surface of 55 square feet and takes steam at 200 lb per square inch, while the distiller has a cooling surface of 90 square feet. The feed pumps to supply the evaporator is a Drysdale "Wee Mac" unit with a capacity of 2 tons per hour against a head of 80ft. A Negretti and Zambra multi-point pyrometer is fitted in the engine-room to indicate steam, feed water and funnel gas temperatures.

The main condensers are of Weir regenerative two-flow pattern, made by Denny Bros. Each has aluminium brass tubes, ¾in. external diameter by 9ft 2½in long, giving a cooling surface of 3000 square feet. The tubes are packed with Crane metallic packing. The condensers work in conjunction with a Weir closed feed system, which includes two closed feed controllers, two electrically driven Weir vertical and stage design extraction pumps, each having a normal capacity of 80,000 lb per hour against 30 lb per square inch pressure from a suction vacuum of 28½in. Other equipment supplied by G. and J. Weir, Ltd., includes two three-stage "Maxivac" steam-operated air ejectors; two horizontal spindle centrifugal three-stage turbo-driven feed pumps, each with a capacity of 80,000 lb to 104,000 lb per hour; two three-flow surface pattern gland steam condensers with ejectors, each with a total of 30 square feet of cooling surface; an eight-flow "U" tube feed water heater with a heating surface of 340 square feet; a horizontal four-flow surface type drain cooler with a cooling surface of 120 square feet; and an electric motor-driven three-throw reciprocating auxiliary feed pump with a capacity of 14,300 lb per hour against a pressure of 550 lb per square inch is installed. The two 16in main circulating pumps are of Drysdale upright centrifugal pattern, each having a capacity of 4750 gallons per minute, and are turbine driven.

Electric current at 225V d.c. for lighting and power is provided by three 150kW diesel generators, by W. H. Allen, Sons and Co., Ltd., each engine having five cylinders, 240mm bore and 300mm stroke, developing 222 b.h.p. at 600 r.p.m., and having its own self-contained lubricating oil and fresh water pumps and coolers. Two W. H. Allen electric motor-driven vertical spindle centrifugal pumps are fitted to provide the circulating salt water for the heat exchangers. For starting purposes three air receivers are fitted, each of 11·2 cubic feet capacity, the air being supplied by two Hamworthy air compressors, one being electrically driven and the other diesel driven. The main switchboard, arranged at the after end of the engine-room with a wide platform running along its front and back is 18ft 8in long by 6ft 6in high and has been supplied by Whipp and Bourne, Ltd., which has supplied emergency and low-power switchboards. A 225V d.c., 35kW emergency generator, driven by a six-cylinder Ruston and Hornsby diesel engine, is fitted on the boat deck. The low-power supply at 25V d.c. is provided by a motor generator and storage battery.

Two lubricating oil pumps for the main engines are installed, each capable of supplying the full requirements of both engines. These electrically driven vertical spindle screw displacement pumps, supplied by Stothert and Pitt, Ltd., each have a capacity of 10,000 gallons per hour at 30 lb per square inch, with a 10ft. suction lift. Serck horizontal oil coolers, Auto-Klean discharge strainers, perforated plate suction strainers, and Philips suction-magnetic filters are fitted. The lubricating oil purifier is a Sharples centrifugal oil separator, of a 200 gallons per hour capacity.

Two Worthington-Simpson vertical "Numarine" self-priming pumps are installed for bilge, ballast, fire, and deck washing, as well as emergency condenser circulating duties, and each has a capacity of 75 tons per hour against a head of 60ft, including a suction lift of 18ft.

Among other equipment may be mentioned: domestic fresh water supply and the sanitary salt water supply by a Drysdale "Pnuepress" system; steam-heated 100-gallon vertical calorifier for the hot water supply, and steam supply is at 60 lb per square inch from the heating boiler; a sewage disposal plant; and an electrically driven diesel oil transfer pump.

As to the general arrangement of the vessel, there are two continuous decks, the main deck (being the car carrying deck) and the promenade deck. Amidships, above the promenade deck, is the boat deck, at the forward end of which is a bridge deck with the navigating bridge, and there is a lower deck forward and aft of the engine and boiler rooms. The vessel is subdivided by eleven watertight bulkheads, and electrically operated horizontal sliding watertight doors, supplied by J. Stone and Co., are fitted to bulkheads in the machinery spaces, with control from the wheelhouse. Welding has been extensively employed in the construction of bulkheads and for the vertical butts of shell plating. In the wheelhouse is a full set of modern navigational aids and instruments, including Marconi radio locator, marine radar, Fathometer echo sounder, Chernikeef electric log repeater, Willet Bruce automatic whistle control, Siemens Elliott engine revolution indicator, Siemens rudder indicator, Siemens electric main and emergency and docking and steering telegraphs, a 10in signalling projector, a Clifford and Snell loudspeaking telephone and amplifying system providing communication between bridge, engine-room and mooring positions, and a sound reproduction unit.

SMOKE ROOM

CAR DECK

As will be gathered from the illustrations, the passenger accommodation is of a high standard and includes a well-appointed smokeroom and bar on the boat deck, seating seventy-five people. On the promenade deck there is a spacious lounge buffet in two sections, leading into the lounge proper, which extends the full width of the ship. Aft of this lounge are grouped the passport office, ticket office and the bank. There are eight private cabins, and also a ladies' rest room, while immediately abaft of amidships is the restaurant, which extends the full width of the vessel and seats 140 persons.

The motor-car space is divided into four separate compartments, and there are portable racks for storing sixty motor-cycles in the forward garage. The deck in the garage space is painted with an oil-resisting non-skid paint, with white track markings arranged on flat bars welded to the deck for the guidance of motorists driving on board. Special attention has been paid to the securing of cars.

There are seven Class I lifeboats and one Class B motor boat, all supplied by A. and C. Head, of Greenock. The "accident" boats on the bridge deck are carried in Taylor "Crescent" davits, while the others on the boat deck are carried in Taylor "Col" overframe davits. Mills disengaging gear is fitted. There is also an excellent equipment for fire alarm and fire fighting. This consists of fireproof bulkheads and doors, a Grinnell automatic sprinkler system, supplied by Mather and Platt, Ltd., and installed throughout the accommodation and the car deck, which has, in addition, fireproof curtains dividing it into four.

RESEARCH LABORATORIES OF BABCOCK AND WILCOX, LTD.

FIG. 1—CHEMICAL SECTION—BALANCE AND COMBUSTION ROOM

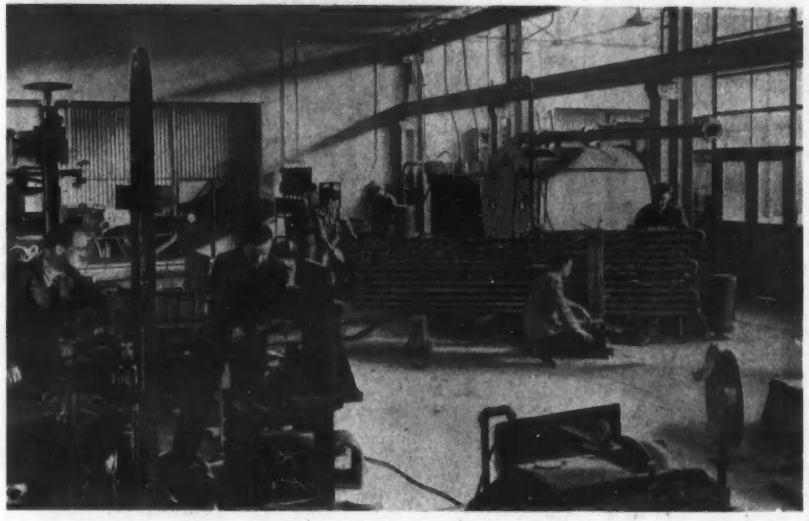


FIG. 2—ENGINEERING RESEARCH BAY

FIG. 3—PART OF COMBUSTION BAY

FIG. 4—PART OF METALLURGICAL LABORATORY

Research Laboratories of Babcock and Wilcox, Ltd.

No. I

In 1950 Babcock and Wilcox, Ltd., acquired new premises for use as research laboratories about 1¼ miles from the main Renfrew works. Research work, carried on in laboratories at the Renfrew works and in various departments of that works, has been transferred to the new premises, and new research buildings are to be built to expand the floor area available. A short account is here given of what was seen during a recent visit to the new laboratories.

IN recent years and particularly since the war we have repeatedly been called upon to visit and describe the research laboratories set up by engineering firms. Recently we took part in a visit to the relatively new research laboratories of Babcock and Wilcox, Ltd., at Renfrew, and we herewith intend to describe these laboratories. Before doing so, however, it is desirable to point out that the post-war erection of special research buildings by industrial firms does not mean that it is only since the war that they have taken an interest in research. Nearly always it will be found upon inquiry that what has happened is merely the centralisation for greater convenience in a single building or group of buildings of work that was formerly carried on in separate shops and departments of the production works. Certainly Babcock and Wilcox, Ltd., has carried out research and development with the object of improving its products for very many years. A mechanical test house and a chemical laboratory existed many years back as separate entities, and much work, most of it on a purely *ad hoc* basis, was carried out by individual departments. By 1936 a great deal of this work had been co-ordinated into a research department with well-equipped laboratories at the Renfrew works. But since then the extension of the activities of the firm, combined with that heightening of interest in research that industry in general has been feeling, has led to a considerable increase in the amount of work falling to be done by the research department. To allow for that expansion, new premises were acquired in 1950 in High Street, Renfrew, about 1¼ miles from the works, and laboratory equipment was transferred there and new equipment acquired. A rough plan, not to scale, is seen in Fig. 5 to show the situation of the various departments,

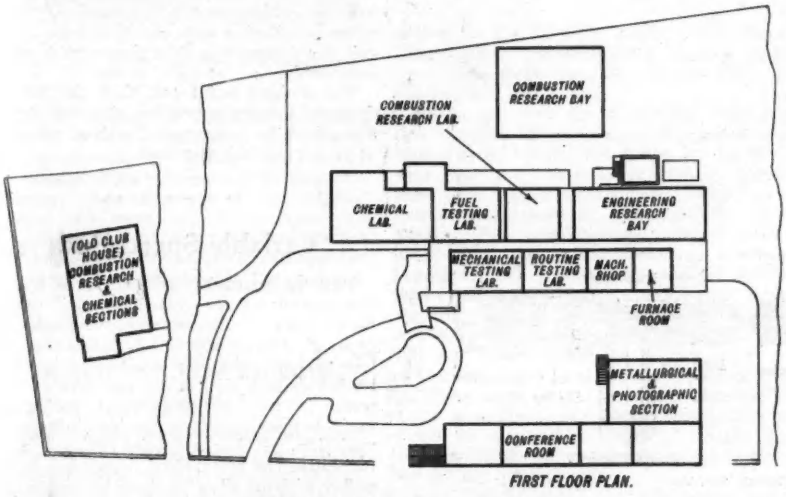


FIG. 5—DEPARTMENT LOCATION PLAN

and a photograph of the main research building appears in Fig. 6. Maybe the structure is less imposing to an outward view than other research laboratories that we have recently illustrated. But, as we found at the time of our visit, internally it is well equipped and conveniently arranged. Some general views of a number of departments are reproduced in Figs. 1, 2, 3 and 4 on page 856. The main two-storey block has a floor area of 22,000 square feet. Behind it is a combustion research building with a floor area of 5000 square feet. Further single-storey buildings are to be erected to increase the total floor area by a further 22,000 square feet. Temporarily certain researches into combustion and scaling problems are accommodated in what was once a golf club house not far from the other buildings. Full-scale boiler researches are carried out at the main works, where the steam generated in a 1500 lb per square inch, 850 deg. Fah., 40,000 lb per hour boiler and two 450 lb per square inch, 550 deg. Fah. boilers with capacities of 40,000 lb and 60,000 lb per hour can be usefully employed. Certain other researches are also still carried out at the main works. But eventually all work not requiring large quantities of steam will be concentrated at the new research station.

We found much to see of absorbing interest at these new laboratories. The following account is very far from exhaustive. Not only does it omit almost all reference to routine work; shortage of space has made it necessary to say nothing about a number of true research and development activities going on at the laboratories. But it will, we hope, give an adequate impression of at least some of the work that is being pressed forward, and of the value of the organisation to the firm.

CHEMICAL SECTION

In the chemical section there are the usual chemical laboratories, together with balance rooms, &c. Here we noticed modern equipment for spectrographic analysis and for calorimetric analysis. Developments in the production of protective coatings are studied here and materials are subjected to heat and acid-resisting tests which have been standardised in the laboratory. As might well be expected in the research organisation of a firm manufacturing boiler plant, investigations are made into the scaling characteristics of metals at elevated temperatures. Each test specimen consists of a tubular section machined from a solid bar of the metal concerned. It is weighed cold and suspended in the centre of an electric furnace, into which flue gas of any desired composition can be injected. Each specimen is weighed cold at intervals of 100 hours, and there is provision for hot weighing while in the furnace. Results, as a rule, turn out to be exponential in form, the rate at which weight is lost falling off with time. There is a "kick" in the curve each time the specimen is cooled and reheated, but overall the shape of the curve remains exponential.

(To be continued)

FIG. 6—RENFREW RESEARCH STATION

Electrically Operated Tower Crane

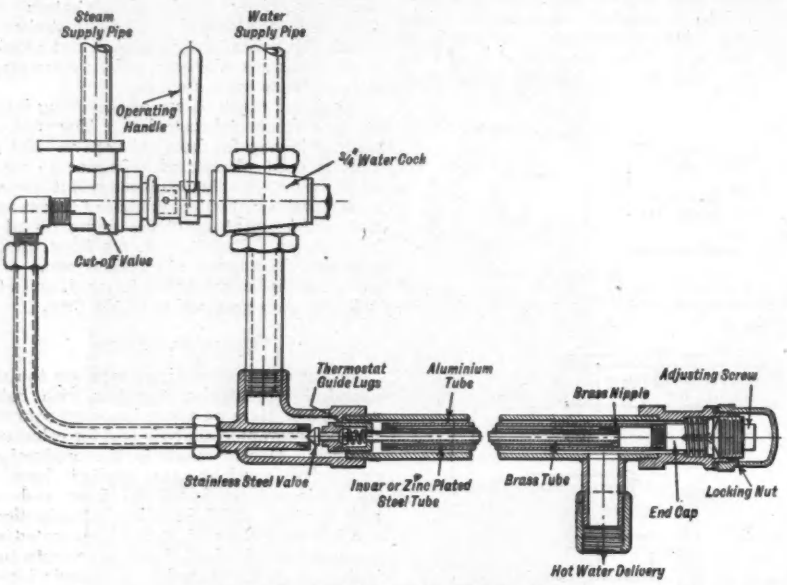
THE very first sentence of the article under this title, which appeared in our issue of June 13th, read: "Tower cranes have been in use on the Continent for many years, but it is only recently that they have become available in this country. . . . ." The error will be obvious to all who have taken any interest in such cranes. For, these very many years past, tower cranes have been made and have been operating in this country, and indeed it is probable that a claim that they originated here could be sustained. What we should have written was: "Tower cranes of the type illustrated below . . ., &c." For the design of the crane concerned is significantly different from that of the tower cranes that are quite familiar here. Then the following remark, so misleading, as printed, in its implication would have become justifiable. But we did not so write the sentence. Our apologies are certainly due to manufacturers of tower cranes in this country.

A Mixing Valve with Thermostatic Control

We have received from the London Midland Region of British Railways particulars of an interesting thermostatically controlled steam and water mixing valve which has been developed at the Wolverton carriage works for supplying hot water to the workshops. Valves to this design have been made and are set to supply 2 gallons of water a minute at a temperature of 110 deg. Fah., operating with a steam pressure of 50 lb per square inch. This delivery of water is sufficient to supply twenty sprays in the shops.

The construction and operation of the valve can be clearly seen in the drawing we reproduce. It consists essentially of a thermostat, a thermostat outer cover, a brass fitting for steam and water admission, and a brass fitting for thermostat adjustment.

The thermostat consists of three tubes fitted one inside the other and containing at one end a stainless steel valve. At the other end a fitting carries a spring which keeps the valve back from its seating, so that the expansion of the thermostat is always in a forward direction.



STEAM AND WATER MIXING VALVE

An aluminium tube, ½in outer diameter and $\frac{3}{16}$in internal diameter, forms the outer unit of the thermostat. A tube of either Invar or zinc-plated steel, preferably of Invar, is secured inside the aluminium tube at one end by means of a brass nipple and at the other end a plain brass nipple is soldered for centralising purposes.

A brass tube screwed at one end to the Invar tube has at the other end a brass nipple which carries the stainless steel valve.

The outer cover of the thermostat consists of a 1in internal diameter tube, preferably of Invar, threaded each end and having a 1in nipple with a socket welded to it through which the hot water is delivered to the sprays. A cast brass fitting for steam and water admission contains a stainless steel valve seating and three guide lugs for centralising the thermostat and valve.

When it is required to adjust the setting of the thermostat the brass cap at the right-hand end of the assembly is removed and the locking nut on the adjusting screw loosened. The adjusting screw, which has a tapered spigot projecting into the thermostat end cap for centralising purposes, can then be reset. This end cap is tapped to facilitate the removal of the complete thermostat unit from the casing.

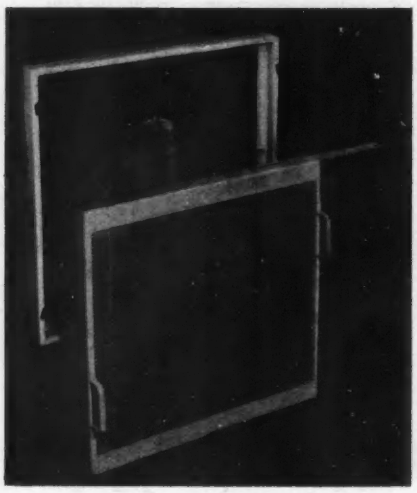
Steam is supplied to the mixer through a modified Westinghouse positive cut-off valve, and this is coupled with a ¾in water cock and operated by a downward movement of a lever. The port opening of the water cock is set slightly in advance of the steam port opening to avoid the danger of scalding.

The way in which the valve operates to control the temperature of the water delivered is fairly obvious. The water flows into the mixing chamber and along the sides of the thermostat to the delivery outlet. The thermostat is actuated by the temperature of the water to move the valve away or towards its seating to increase or decrease the amount of steam mixed with the water and thus raise or lower its temperature.

A Multi-Brush Air Filter

We have received particulars of a recent design of multi-brush air filter which has been developed by Heather Filters, Ltd., 28, St. James's Place, London, S.W.1. As can be seen from the photograph we reproduce, this design of filter employs a series of brushes which present a screen of finely graded intermingling hairs to intercept and trap dust from the air on its passage through the filter.

The material used in the manufacture of the filter brushes is specially selected to ensure durability and efficiency, and to withstand varying humidity and other conditions of dust-laden air. Dust impregnated with oil is stated in no way to impair the efficiency of the filter. The initial filtering efficiency of the brushes is retained after cleansing, which, after a suitable service period, is carried out by means of a vacuum cleaner when the entrained dusts are dry, or where the dust is of an oily nature by washing the brushes in warm, soapy water or detergent. Brushes can be rapidly removed from the filter panel for cleansing, when the front panel has been removed from the frame, in which it is retained against felt packing to ensure airtightness. The brushes are exposed by withdrawing a slide at the top of the panel, and can be removed easily from the compartment in which they are housed.



AIR FILTER COMPONENTS

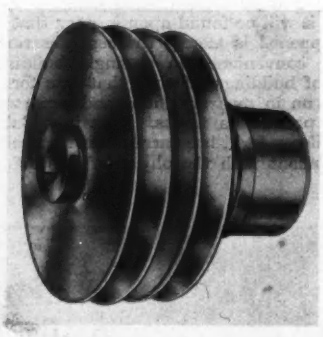
Each filter unit is designed for low resistance to the flow of air, and the recommended duty is 1000 cubic feet per minute at 0·25in W.G., although, where necessary, higher or lower duties may be handled with corresponding increase or decrease in pressure, as for instance a duty of 1200 cubic feet per minute not registering more than 0·4 W.G. The units are manufactured to a standard size, which has been found in practice to be most suitable for general use. They can be arranged singly or as a combination of several units to provide a correct filter area for a given air flow in any size of air-conditioning or ventilation plant. Frames can be designed and manufactured to accommodate any number of filter units, for erection and assembly on the working site. These frame assemblies can be incorporated in a system to present a flat face to the flow of air, or where limited space conditions prevail, for arrangement in cabinet or "V" formation, providing a larger filtering area and thereby a lower air velocity through the filter than would otherwise be possible.

The makers point out that the filters are designed for dry operation, although they can, if required, be impregnated with oil where a wet or viscous filter is required.

Variable Speed Pulleys

The photographs we reproduce show two new models of the "Hainsworth" design of variable-speed pulley which have been developed by J. H. Fenner and Co., Ltd., Marfleet, Hull. One of these units illustrated below is a spring-loaded pulley similar to the firm's "Hainsworth," the single-groove, spring-loaded, variable-speed pulleys having infinite speed variation. It has a special spring box which facilitates the removal of the springs from the pulley without allowing them to extend to their free length.

The second is the two-groove, manually controlled, variable-speed unit shown in the illustration on p. 859. In it the two pair of cones are opened and closed, whilst the pulley is either rotating or stationary, by means of handles fitted to the pulley hub. These pulleys are designed to operate in conjunction with the matching two-groove, spring-loaded units.

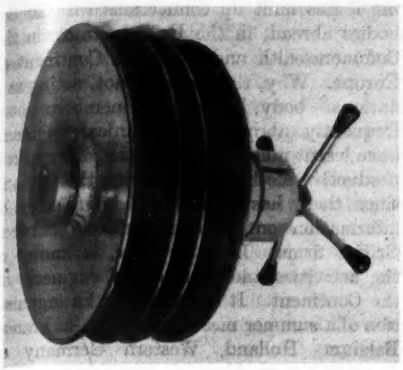


MULTI-GROOVE VARIABLE SPEED PULLEY

When the spring-loaded pulley is to be used alone it is fitted to the shaft of a motor mounted on an adjustable sole plate, and either a two-grooved fixed diameter pulley or a flat pulley can be fitted to the driven shaft. Speed variation is then obtained by altering the centre distance, when the motor is pulled away from the drive shaft the two belts descend in their grooves and reduce the driven speed. When the centre distance is decreased the springs force the variable-speed pulley cones together, caus-

ing the belts to rise in their grooves, thus increasing the driven speed. This arrangement provides a simple and effective method of infinite speed variation with a total range of 2 to 1.

If both designs of pulley are to be used together, the manually controlled pulley is fitted to either the motor or drive shaft and the spring-loaded pulley to the other shaft. Once the drive has been installed the centre distance remains fixed, and speed variation is obtained



MANUALLY CONTROLLED VARIABLE SPEED PULLEY

by opening or closing the manually controlled pulley cones. As the cones open in the manual pulley they close in the spring-loaded pulley and the belts go from maximum pitch diameter to minimum pitch diameter on the manual pulley, and *vice versa*, on the spring-loaded pulley. Closing the manually controlled grooves has the reverse effect, and with such an installation an overall speed ratio of 4 to 1 is obtained.

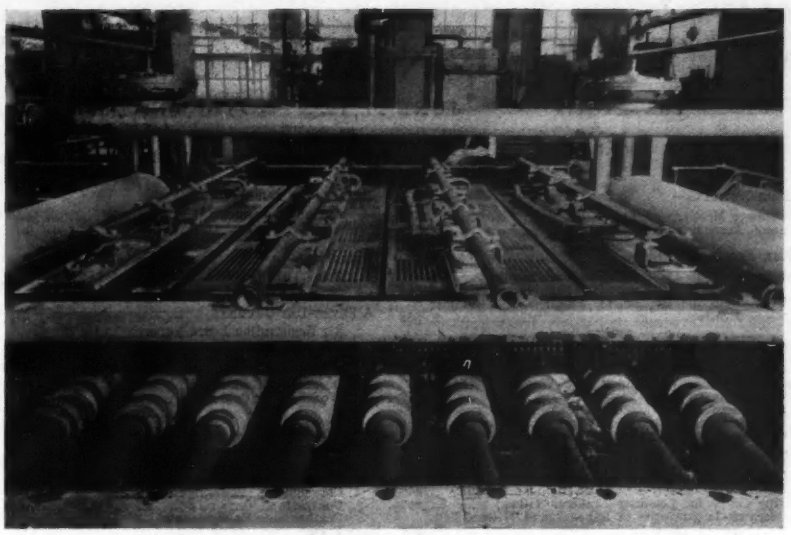
A Pipe Clamp for Loading Tankers

SUCCESSFUL tests have recently been completed of a new pipe clamp for coupling loading and discharge lines to the pumping system of oil tankers and it is intended to adopt this clamp as standard equipment on most of the oil tankers of the Shell fleet. The clamp, which has been devised by Mr. John Lamb, head of the Marine Development and Research Department, enables the blank flange to be removed and the flexible shore line to be connected to the tanker's loading and discharge lines in about two and a half minutes, as compared with thirty to sixty minutes when using the present equipment.

There are two parts forming the clamp, one consists of a hinged adjustable collar immediately behind the flange on the flexible shore line and the other is a short length of mild steel piping permanently bolted to the end of the intake or discharge line on the tanker. Four hand operated hinged arms are fitted on this pipe and these hold the shore-to-ship lines in position, and replace the present system of bolts, nuts and bolted clamps. To ensure a perfect connection and to give an additional measure of safety, two guide arms, 120 deg. apart, project from the under side of the fitting and once the short pipe is resting on these arms it is practically impossible to make a faulty connection. Our photograph shows the shore lines connected to the ship's pipes by means of the clamp and oil passing at 100 lb per square inch.

A millboard packing-ring prevents leakage at the point of union and throughout the tests a pressure of 120 lb per square inch was maintained while the bench test pressure was three times greater. A successful demonstration was carried out on the "Velutina" and the device will be tested again when the ship loads at Mena-al-Ahmadi, Kuwait. When the ship returns it will be fitted with adaptors so that the fitting may be used with either American or British standard pipes.

CLAMP WITH HOSE CONNECTED



INFRA-RED PROJECTORS FOR INITIAL ADHESION OF SANDWICH

Infra-Red Heating in Safety Glass Production

AN interesting application of the use of infra-red energy is in the production of safety glass at the Triplex Safety Glass Company's works, near Birmingham. In this process a Vinal layer is placed between two glass sheets and preliminary adhesion is obtained by applying heat and pressure. The two panes of glass and the Vinal intermediate layer are assembled on a conveyor belt, which passes through the assembly room, the two panes being located relative to each other by special templates, which ensure that the edges are in exact alignment. The assembly is then passed through a series of rubber-covered pressure rollers, which cause initial adhesion between the glass and the Vinal, and during this process heat is applied by electric infra-red units. Final adhesion is obtained by placing the glass in autoclaves where it is subjected to predetermined pressure and temperature.

The infra-red units include Metropolitan-Vickers electric infra-red projectors fitted with tubular sheathed elements, which operate at red heat. These elements consist of a spiral of high grade heat-resisting wire tightly embedded by a special process in a mineral insulator, enclosed solidly in a tight sheath of $\frac{1}{16}$in tube of a non-scaling, non-corrodible alloy. The process ensures that the spiral is held immovable in the centre of the bore so that an even thickness of insulation separates it from the sheath. The projectors themselves consist of a trough reflector in a robust frame designed for maximum strength consistent with light weight. The reflectors are constructed from high grade aluminium sheet, which has been subjected to a special anodising process to give maximum heat reflection and to protect them from atmospheric corrosion. These projectors form clean and efficient units adaptable to any production line, enabling an intense energy concentration to be obtained where required.

LLOYD'S REGISTER OF SHIPPING.—Lloyd's Register of Shipping states that following the appointment of Mr. J. Hodgson as Chief Ship Surveyor, the General Committee has appointed Mr. H. P. Southwell to succeed him and has also appointed Mr. J. M. Murray, M.B.E., the Principal Surveyor for Research, to be an Assistant Chief Ship Surveyor.

THE ENGINEER

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SUMMER MEETINGS OF THE "MECHANICALS"

WERE choice confined to within the borders of the United Kingdom, it would not be easy to find a place better suited for a summer meeting of the Institution of Mechanical Engineers than Bristol, where the members of that Institution spent three days last week. Romantically, sea-going ships berth at quays in the very centre of that city, so that landsmen are made aware, even upon each day's mundane business, how much Bristol depends for its prosperity upon seaborne commerce. Then, to emphasise how ancient is the city there are scattered about Bristol, as about York, Canterbury, and other historic towns, numerous mediæval churches, many of them now—alas!—roofless and windowless by consequence of wartime bombing. On a hill above the streets stands the Cabot memorial tower as a reminder that it was from here that the Cabots sailed on voyages of discovery to North America. Amongst the city's inhabitants, too, there must be few who attach no significance to the name of Brunel, even though some may connect it only with the fine suspension bridge over the Avon gorge, to the exclusion of his other more famous engineering works. Here, as Sir David Pye remarked, in replying to the welcome bestowed by the Lord Mayor on the first day of the meeting, the first brass was made in England and the first steamship planned and built. Here, Macadam worked. Here, too, the Great Western Railway was first projected, and here, again, is the home of that society whose romantic title epitomises the energy and courage of this city's people, the Society of Merchant Venturers. Bristol is, indeed, a historic place for engineers to visit.

But Bristol has claims, better than those of historical association alone, to be a meeting place of engineers. It cannot vie with such places as Glasgow, Newcastle, Manchester and Birmingham in intensity of industrialisation. Yet within a radius of 30–40 miles from this city, that is so alive with historic associations, there is to be seen the manufacture of an astonishingly wide variety of engineering products and the use of machinery in the making of many others. Members, besides visiting Avonmouth docks and the Portishead generating station, were able to see the manufacture of locomotives and rolling stock, railway signalling equipment and brake gear, aircraft and aero-engines and aircraft and motor-car accessories, such as propellers and undercarriages, clutches, &c., precision gauges and gear hobs, cranes and public works plant, petrol and diesel engines, steam engines, hydraulic presses and pumps, ball and roller bearings, clocks and watches, automatic packing and wrapping machinery and motor and aircraft tyres, not to speak of the making of numerous other products such as chocolates, printing and paper machinery, paper board, cattle feeding stuffs, earthenware, woollen cloths, plastic products, pianos and the processing of tobacco. It was a feast, indeed, only marred for each member by the necessity each day to make an invidious choice from the number of attractive visits open to him. In the evenings there were a reception, a dinner and a conversazione to allow members, surfeited by technicalities, to relax socially.

Yet despite the attractions of Bristol and the undoubted success of the visit, it cannot really be said that the meeting was well attended. The total attendance amounted to some 300 members and rather more than half as many ladies. But that total, large though it may seem, should be compared with the total corporate membership of the Institution (thus excluding graduates and students, few of whom can afford the money or the time to come) of nearly 20,000. Moreover, at least a quarter of those who attended live in or near Bristol. Why, it may be wondered, does so very large a fraction of the membership fail to put in an appearance at such functions? Over the years the organisation of the summer meetings has tended to become standardised. Besides the indispensable visits to works, there is always a morning devoted to a general technical session and another devoted to an "Automobile Division" paper. On successive evenings there are a reception, a dinner, and a conversazione. It is an excellent arrangement which could hardly be bettered. Yet this constant repetition of a theme, however excellent, does lack variety. It is, indeed, difficult to see how, satisfactorily, changes could be introduced year by year. Yet there is one thing the Institution could do and which we feel it ought to do. Even so lately as just before the war the Institution was still in many ways a relatively small and intimate society. It has since grown in membership and stature into a great national body, and in consonance with its new standing it has built up connections with similar bodies abroad, in the United States, in the Commonwealth and upon the Continent of Europe. Why, then, does it not, acting as a national body, take its members more frequently abroad? Mechanical engineers have learnt much, since the war, of American productive methods, and during the war and since there has been much interchange of information on technical subjects between British firms. Less, however, is known of the activities and methods of engineers on the Continent. It is true that the organisation of a summer meeting abroad—in France, Belgium, Holland, Western Germany or Switzerland, to mention only countries that are relatively close to England—is more troublesome and more costly than that of a similar meeting in the United Kingdom. It is true, also, that there are currency and language difficulties to be overcome. But other institutions successfully organise such visits for their members. If a variation of the habitual theme of the Institution's summer meetings is to be sought, here, we feel, is a way in which it might satisfactorily be found, and such meetings abroad if held at regular intervals might well prove to attract, despite their cost, at least as many members as those held each year in this country. The Institution has not been abroad since it went to Canada, as far back as in 1932. Is it not time it did so? Would it not profit members to see what their competitors upon the Continent are doing?

SOME AERONAUTICAL PROBLEMS

IN many if not most branches of engineering there is a tendency for designs no longer in their first youth to show signs of stabilisation as the years succeed each other. Naturally enough this trend is not unwelcome to many overworked design branches of manufacturing firms, and it might have been thought that since aeronautics is now near its fiftieth birthday such signs would there be apparent. But as it happens, there have arisen in recent years so many novel developments, some of a fundamental character, that a new aeronautical era can be said to have begun; one marked development is the very considerable and sudden growth in flying speeds, civil and military, due in the main to the coming of the gas turbine; another, the increased importance of the problem of fatigue arising from the greater mileage covered by many of the popular airliners; another, the application to aviation of the capacious delta wing, and yet another, the complicated nature of the stability factor in most rotary wing designs.

High flying speeds are liked by airline operating organisations, since they put up the earning capacity, and liked also by the public they serve as they shorten the time occupied in travel which, even by air, can

be distinctly boring. They are not so highly appreciated by those who have to provide the airfields; indeed, Lord Nathan, when Minister of Civil Aviation some four years ago, warned manufacturers that it would not be practicable for an ever larger area of land, and of material and labour, to be allotted for the extension of runways; that aircraft builders should look on it as their duty to make the craft they build fit the existing runways just as ships are made suitable for use in present-day docks—a policy easier to prescribe, of course, than to carry out. One has also to consider the coming of the higher flying speeds in relation to the physiological limitations of the normal pilot. When, as has happened in the space of a few years, air speeds are doubled, the links in the chain of events when taking-off or landing follow each other twice as fast, although the reaction time of the human body, its nerve, muscle and brain, remains unchanged; and if the air speed continues its upward path, as seems not unlikely, some radical change in the method of control may prove essential. This is not unlikely to call for the use of even more auto-pilot mechanisms than there are already, each with their numerous electrical relays, and equally numerous risks of operational failure at critical moments. Suggestions for ways of meeting these many problems are under review in every aero-design department; including the use in civil aircraft of the delta wing with its large volume, great wing area and low landing speed—though the chance of its proving popular in the housing of air travellers is somewhat uncertain. The marked loss of strength in aircraft at the age which some of them now reach makes them seem almost human; though they possess the great advantage, not so far vouchsafed to man, of being able to survive the operation of having certain of their structural members removed and new ones put in instead. In one well-known type of airliner British European Airways are making replacements in the centre section at the end of 8000 hours' flying, and there is little doubt that we have reached the point at which precautionary action of this kind must needs become general.

The use of the rotary wing seems inevitably to be accompanied by difficult problems in stability and, although much skilled attention has been given to them, it can hardly be claimed that any general panacea has yet been found for the trouble. At the moment, if recent reports in the non-technical Press are to be credited, a new form of instability has arisen for consideration. It has long been known that when a helicopter is near the ground, whether about to take-off or to alight, the lift given by the windmill is increased markedly and usefully by ground effect; but if the helicopter is of the two-windmill design, as many are, and especially if one rotor is mounted higher up than the other, there is every chance that this sudden accession of ground effect will not be simultaneous at the two ends, so that a pitching moment will come into play, itself subject to periodic change with attitude as the pitching takes place. This may open the door to a resonance effect hard to control; in fact, the lay Press report the phenomenon to have already been encountered on both sides of the Atlantic, and somewhat irreverently describe it as a sort of "St. Vitus's Dance." But it must be taken seriously if, as reported, an American prototype helicopter under test was reduced to matchwood by this kind of shimmy in a few moments. Whether one watches the development of fixed wing aircraft with their growing speed and comfort, or the many rotary varieties with their modest demand for landing facilities and their considerable convenience for certain services, one cannot doubt the increasingly wide scope for the use of the highest qualities of imagination and ingenuity on the part of our aircraft designers.

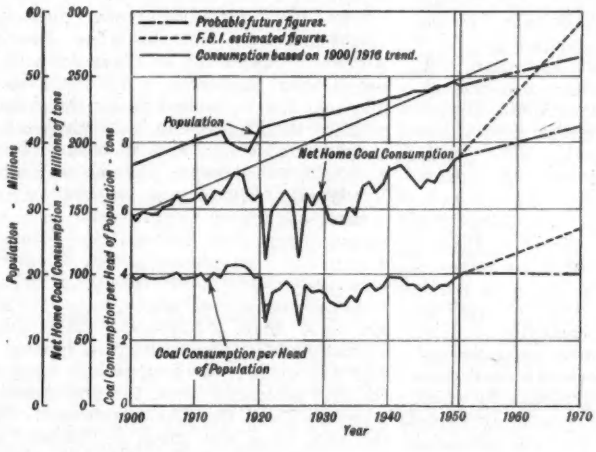
Letters to the Editor

(We do not hold ourselves responsible for the opinions of our correspondents)

THE FUTURE DEMAND FOR COAL

SIR,—As seems to happen every ten years or so, it is fashionable nowadays to make alarming references to the impossibility of meeting the future demand for coal and to criticise all types of coal users for their part in bringing about this state of affairs. The old type of domestic grate is blamed, very rightly, no doubt, for its inefficiency and voracious appetite; industrial users are told they must be less prodigal in their use of fuel; the gas industry gets a kick because it apparently uses too much coal of an exportable kind and in doing so produces coke which ordinary people often find difficult to burn; whilst those who wish to make full use of the benefits which the inventors of electrical generation have given the world are in danger of being classed as saboteurs.

Everyone will agree that increased efficiency in the use of every commodity is important, especially so in the case of fuel. Much, however, has been and is being done. New grates are being installed in our homes, efforts are being made to increase the efficiency of the production of gas and of the appliances which use it, and the power stations are bettering each year the very great achievements already made in producing more electricity per ton of the low-grade fuels delivered to them.



It is more than likely that as in the past a tremendous amount of energy will be spent in delving into the question only to find that by the time remedies have been found the problem no longer exists.

Let us examine the Federation of British Industries' estimated future demand for coal. Whereas the net home coal consumption for 1951 was about 194 million tons, the F.B.I. estimate that by 1961–65 it is likely to rise to some 256 million tons. The attached graph shows that the consumption per head of population only exceeded 4 tons a year during the artificial conditions of the 1914–18 war. Assuming therefore that, despite the increased efficiency brought about by the new grates and more efficient gas and electrical generation and use, consumption per head does not fall substantially below 4 tons a year, home coal requirements in 1961–65 will probably be 52 million × 4 tons, or about 208 million tons. This is nearly 50 million tons below the F.B.I. estimates, which seem to have been arrived at by simply extending the total net home coal consumption line on the assumption that it will follow the trend shown for the last five years. If, however, the same procedure had been adopted for the years 1900–1917 the trend line would have indicated a total net home coal consumption of 250 million tons by 1951, or over 5 tons per head of the population. Why has not this happened? One of the main reasons is that electricity supply started a period of most rapid development about 1916 and the efficiency of use increased so much that many millions of tons of coal (mostly low grade) were saved over the years. Moreover, the efficient use of these low grades of coal for which there had previously been little demand enabled our increased industrial productivity to be achieved without a correspondingly large increase in the consumption of industrial coal.

What about export? Gross production is expected to reach at least 240 million tons by 1965. If the consumption per head of the population does not fall below 4 tons per annum by then there would be an apparent balance of 240 million − 208 million = 32 million tons in that year. After allowing, say, 7 million tons for colliery use, there would be some 25 million tons of coal available for export, a more cheering picture than given by the present gloomy forecasts.

R. E. GANILEN

Brighton, June 16th.

USE OF RAILCARS

SIR,—I was very impressed by the capabilities and performance of the experimental lightweight diesel train described on page 740 of THE ENGINEER dated May 30th.

However, railcars of this type have been made by several of the leading bus and coach firms for a number of years and would appear to be now out of the experimental stage.

It is noted that this particular train is to be used on experimental services on Outer London suburban lines.

However, modern lightweight railcars would seem to be ideally suited to branch line working, and it is rather strange that greater use is not made of them for this purpose.

Have British Railways ever considered trying out a modern motor-driven railcar on any of the branch lines which have been closed because they do not pay? Why do they not select one of these uneconomical branch lines and try a lightweight railcar for a period of, say, three months and see what happens? The results might surprise them.

In the writer's opinion the main reason why many of these branch lines are so little used is because the oldest, filthiest, most un-

comfortable rolling stock is relegated to them together with ancient, smelly locomotives which seem incapable of travelling at more than a snail's pace. Who would want to travel on such a line ?

With a modern motor-driven railcar a better, faster service could be provided at less cost ; track maintenance would be less with a light vehicle, and it is thought that more passenger traffic would be attracted and the line then made to pay.

What about it, British Railways ?

D. G. WETTON

Colchester, June 20th.

[On Western Region branch lines, if not those of other regions, too, quite extensive use is already made of lightweight diesel railcars.—ED THE E.]

Obituary

COLONEL WALLACE C. DEVEREUX, C.B.E.

WE record with regret the death of Colonel Wallace Charles Devereux, which occurred, suddenly, on Saturday last, June 21st, at his home at "Meads," Stoke Park, Bucks. Colonel Devereux, who was fifty-nine, had for many years occupied a prominent place in the light metals industry of this country.

Wallace Devereux was educated at King Edward's Grammar School, Aston, Birmingham, and subsequently studied engineering and metallurgy. As a young man, in the first world war, he was appointed to the responsible position of superintendent of the National Aircraft Factory No. I. In the 1920s he was engaged in work related to industrial reconstruction on the Continent, and later founded High Duty Alloys, Ltd., at Slough, for research into and the commercial production of high-strength alloys. When the second world war broke out Colonel Devereux became Director of Light Alloy Forgings and Stampings, and in 1941 he undertook, for the Ministry of Aircraft Production, the organisation for the reception and assembly in this country of American aircraft. He also reorganised the arrangements throughout Great Britain for the repair of aircraft and aero-engines.

After the war Colonel Devereux continued his research activities and was responsible for the formation of Almin, Ltd., of which he was managing director. He was also chairman of International Alloys, Ltd., Southern Forge, Ltd., Renfrew Foundries, Ltd., Warwick Production Company, Ltd., and Structural and Mechanical Development Engineers, Ltd. In addition, Colonel Devereux took a large share of the responsibility in the founding of the Fulmer Research Institute, of which he was the chairman. In the course of his career he contributed many papers on industrial research generally and light metals research in particular to various learned societies. Another matter to which Colonel Devereux gave much attention towards the end of the war was industrial reconstruction and development in this country. Two reports which he prepared dealt in considerable detail with the post-war reconstruction of industry in South Wales, and an industrial plan for Cumberland.

Colonel Devereux was a Fellow of the Royal Aeronautical Society and a member of the Institution of Naval Architects. His interests, apart from his metallurgical and research work, were many, among them being farming by thoroughly up-to-date methods at Kimble, in Buckinghamshire. He was awarded the C.B.E. in 1949 in recognition of his services to research and industry.

The Institution of Mechanical Engineers

SUMMER MEETING

LAST week the Institution of Mechanical Engineers held its Summer Meeting at Bristol. It was attended by some 302 members and 165 ladies. The party gathered in Bristol on Monday, June 16th, and its official reception took place the following morning at the Embassy cinema. The Institution was welcomed to Bristol by the Lord Mayor, Alderman V. J. Ross, J.P., and by members of the Bristol Reception Committee. In welcoming the members and their ladies the Lord Mayor stressed that the city had a great deal of interest for engineers. Indeed, he believed there were working in engineering in Bristol more people than in any other capacity. He hoped the members would enjoy their visit and felt that both they and the people of Bristol would benefit from it. For Bristol's connection with engineering went very far back, at least as far back as the days of Brunel, much of whose work had lain in and around the city. But though it had an interesting engineering history, Bristol had kept up with the times. It had constantly added to the variety of its industries, as, for instance, by the foundation at Filton of aircraft and aero-engine manufacturing. Parts of the city had suffered severely from bombing attacks ten years ago ; and it had not yet been possible to do much rebuilding. But they intended eventually to rebuild the city on modern lines. He was delighted to welcome the members of the Institution and their ladies to the city.

In reply the president, Sir David Pye, remarked that there was something romantic about Bristol, a city into whose very centre ocean-going ships penetrated. Possibly that had something to do with the adventurous spirit that had constantly been shown by Bristol men ever since the middle ages. Bristol was the home of the Society of Merchant Venturers, whose title, he felt, typified the spirit of the town. Bristolians would not agree that Columbus discovered America. According to them John Cabot sailed from Bristol in a 100-ton ship for fifty-two days westward across the Atlantic to plant the English flag in North America ; and he and his crew were all back in Bristol a whole year before Columbus started ! Yet though Bristol was an historic city, normal provincial development had continued unchecked through the centuries and it had continuously shown commercial enterprise. In other towns of historic fame progress seemed almost to have ceased. But not here. Amongst other things, Bristol had led the country in having the first free library, the first savings bank and the first provincial bank, the first American consulate—and the first workhouse ! Here the first brass was made in England and here, too, the first steamship was planned and built. The initiation of the Great Western Railway was almost entirely a Bristol product. That same spirit of enterprise which had led to the creation of these things was shown to-day in the variety of the city's products. Members would be seeing firms engaged in making aeroplanes and aero-engines, paper products, tobacco products, chocolates and varied kinds of machinery. Indeed, there was a really quite remarkable variety of engineering activity to be seen in and around Bristol. The Institution was glad to be revisiting a city at which it had last held a summer meeting in 1930.

At this stage the Lord Mayor had to leave to attend to other business in the city. The members, however, remained to hear read by Mr. A. B. Cooper an excellent paper on "Mechanical Engineering Around Bristol" and to discuss it.

After lunch, which was taken in the Victoria Rooms, members dispersed to take part in a number of visits to firms in and near Bristol. It was our original intention, since our representative could attend only very few of the many visits open to members, to make no reference at all even to those firms that he visited, on the ground that to do so would be unfair to other firms who had as much put themselves out in order to honour their guests. In fact, however, the reception accorded members at every firm visited was so generous that we feel that it would be discourteous, not only to those firms our representative visited but to the many others, too, not to make at least some reference at least to the former. On this day, then, our representative attended the visit to Brecknell, Munro and Rogers, Ltd., of Bristol. This firm was started in 1860 as a small non-ferrous foundry. To-day it makes a variety of automatic machines for food-handling and the like. Members were able to see, for instance, the interior functioning of those automatic ticket-issuing machines so familiar on London's Underground ; and to watch in operation and under manufacture automatic moulding and wrapping machines for packaging butter and margarine. The butter is fed in large "dollops" into a hopper at one end and fed by double-screw conveyor into the machine, where it is weighed into one pound of the rectangular section so familiar at the grocers and wrapped in grease-proof paper for delivery. No doubt the over well-informed can explain that it is "all done by cams." But the ingenuity of the mechanisms is still remarkable. Other machines were also seen, a machine for packaging powdered and granulated substances—the pneumatic method of handling and opening paper bags for the reception of the material proved particularly attractive to watch—a yeast wrapping machine, a three-colour, high-speed precision printing machine, an egg-grading and stamping machine and a laundry washing machine. The time was all too short fully to appreciate the technical ingenuity exhibited in the design of these machines.

In the evening there was a reception by the Lord Mayor and Lady Mayoress in the Bristol Museum and Art Gallery. Amongst other exhibits of which we took note here were a number of excellent models of sailing vessels, some of them intricate with full-rigging, including two of the famous clipper "Cutty Sark," which was built at Bristol.

On the Wednesday members had a wide variety of choice. The Automobile Division had arranged for a technical meeting and discussion in the morning and half-day visits were available in the afternoon for those who attended the meeting. Alternatively, a variety of morning and afternoon visits were available. Our representative chose to make a whole-day visit to the Bristol Aeroplane Company, Ltd., at

Filton. Here, in the morning, he saw "Hercules" and "Centaurus" sleeve-valve piston engines and "Proteus" propeller turbine engines under manufacture. All three engines have at one time or another been described in our columns. In the afternoon a visit was paid to the "Brabazon" hangar, a very impressive structure, far more impressive to view than to see illustrated in a photograph. One bay of this building is now used by B.O.A.C. for maintaining and repairing its fleet of aircraft. In another various aircraft, including the new "Britannia," were under erection; and the third houses the "Brabazon Mark I" and the partly constructed "Brabazon Mark II." Members had the opportunity to inspect the "Brabazon Mark I" and to see how it is fitted up with a variety of instruments for carrying out research tests while in flight. It may be that the "Brabazon Mark II" will never be completed and it is unlikely that the "Brabazon Mark I" will ever fly as a passenger-carrying craft. But even if the project for these craft has cost many millions of pounds a great proportion of that cost is represented by solid assets such as the hangar itself and the "Brabazon" runway nearby; and without the researches carried out before the "Brabazon" was built and within the "Brabazon" in flight it is very doubtful whether such a craft as the "Britannia," which is to have an all-up weight of 140,000 lb and will carry a payload of 25,000 lb over a distance of 4000 statute miles, could have been satisfactorily conceived or confidently built.

In the evening the Institution Dinner was held at the Victoria Rooms. The toast of the "City and County of Bristol" was proposed by Mr. R. W. Bailey, who remarked that Bristol was renowned for its hospitality. It was a city that had always taken an interest in transport, first in sea transport then, in the time of Brunel, in railways as well as ships, and more recently in air transport. The flow of trade through the city thus being stimulated Bristol had built up a reputation for great enterprise. It had also shown great interest in education and research. The members of the Institution shared with Bristolians their pride in their work and achievements. The Lord Mayor, in reply, after references to the history of Bristol, to the Society of Merchant Venturers, and to the founding of the Bristol Aeroplane Company, Ltd., by the late Sir George White, remarked that the town had received a hammering ten years ago; but that Bristolians were now heartily interested in redeveloping the city centre on sound lines. For they feared that as a consequence of the damage suffered they were losing trade to Bath and Cheltenham. They hoped to build a Civic Centre of which they could be proud.

Next, Sir David Pye, in proposing the toast of "The Guests," referred to the "all too short" stay of the members in the city and the generous hospitality they had received. The chief object of the dinner was to show hospitality to those who had been and were to be hosts to the members and to indicate how deeply grateful the members were for the hard work that had been done in preparation for the summer meeting. He offered the thanks of the Institution to Mr. Lyne, who was Lord Mayor when the visit was in progress of organisation, to Professor Morrison, who was chairman of the executive committee of the reception committee and to other members of that committee and coupled the names of Mr. Verdon Smith, who was chairman of the reception committee, and Sir Philip Morris, Vice-Chancellor of the University of Bristol, with the toast. When Mr. Verdon Smith and Sir Philip had replied the function came to an end.

On the last day, Thursday, of the summer meeting our representative chose, from a very attractive variety of visits to firms at Cheltenham, Cleeve, Gloucester, Dursley, Stroud, Melksham and Chippenham, to go to the locomotive and carriage works of British Railways at Swindon. Here the party was led through the works by Mr. R. A. Smeddle, chief mechanical and electrical engineer, Western Region. The first object seen in what proved to be an all too short visit to so interesting a works, was the Metrovick gas-turbine locomotive No. 18,100, which has already been fully described in our columns. Visits were then paid to the erecting and machine shop, the wheel shop, the boiler shop and the locomotive testing shop, where a locomotive was seen under test. After lunch members of the party were able to see first the iron foundry and tool-room and, later, to visit the carriage works, which is capable of an annual output of 275 new coaches and new wagons of various types, equivalent to 5000 of the 13-ton open wagons, besides repairs to coaches and wagons. Unfortunately, owing to the steel shortage new coach construction is almost at a standstill at present.

For the return to Bristol by rail the Western Region had very kindly arranged for the train in which members travelled in several coaches to be drawn by the Metrovick gas-turbine locomotive. The power of the locomotive to handle a train that must have been in weight equivalent to a normal express on the route concerned was very amply demonstrated. Between Swindon and Chippenham a speed roughly checked by wrist-watch against mile-posts very well in excess of 80 m.p.h. was reached. The getaway at Swindon and at Chippenham and Bath at which stops were made, was noticeably smooth, deceptively so, in fact, for the speed increased, we suspect, more rapidly than it appeared to. The locomotive is unpleasantly noisy when standing at stations. But in running, passengers are not aware of the noise even in the front coach of the train. The thanks of the members were certainly due to British Railways, Western Region, for providing them with this interesting experience.

The summer meeting came to an end on Thursday night at the close of a Conversazione held in the Victoria Rooms by invitation of the Western Branch Committee.

Jubilee of the Paterson Engineering Company, Ltd.

LAST Monday the Jubilee of the Paterson Engineering Company, Ltd., was celebrated at a Reception at the Apothecaries Hall in the City of London. A large and distinguished number of guests were received by Sir William Paterson, the founder and chairman of the company, and by Lady Paterson. The principal speakers were two friends made in his youth by Sir William and retained ever since despite wide differences in their callings, Lord Waverley and Prof. Sir Alexander Gray, respectively. They had been three young men together in Scotland for training for their life's work; and they came together again to honour Sir William, one of their number, some fifty years later.

William Paterson, as he then was, was born in 1874. Early in his twenties, when his technical training at Heriot Watt College, Edinburgh, and apprenticeship at James Bertram and Sons had been completed, his attention was attracted by the number of boiler failures in power stations resulting from the presence of oil in feed water. He set out to find a solution and in 1902, believing he had the solution, he started the Paterson Engineering Company, Ltd., as a private concern with a capital of £700. The following years were hard ones. For William Paterson carried on the business single-handed. About 1910, however, he decided to expand the scope of his business. So far he had been concerned to provide efficient and economical means for softening and filtering water for industrial purposes. Now he proposed to enter the field of water purification for public drinking supply. He was almost immediately successful. The first installation for the purpose was for the Weardale and Consett Water Company, for the prefiltration of 2 million gallons of water per day. An installation of similar capacity for Cheltenham followed; and in July, 1914, a plant to deal with 4 million gallons a day was opened by King George V for the Clydebank and District Water Trust. We need follow the progress of the company in detail no further. In 1952 it has become probably the largest organisation in the world specialising in water treatment. Two further examples of Paterson's skill should, however, be mentioned. During the 1914–18 war he developed apparatus for the sterilisation of water by the addition of chlorine in the pure gaseous state. The first installation went into service at one of the pumping stations of the Metropolitan Water Board in 1917. During the last war he had a totally different contribution to make. In 1939 he was urgently asked by Lord Waverley, then Sir John Anderson, to devise a form of air-raid shelter suitable for protection against blast and flying debris and capable of rapid production in very large numbers at a low cost. The well-known "Anderson" shelter, which gave protection to millions during the war and saved unnumbered lives was the result. It was patented—to prevent commercial exploitation—and the patent was presented by Paterson to the nation. Sir William received his knighthood in 1944 and in 1948 he was elected an Honorary Member of the Institution of Water Engineers.

Books of Reference

Ship and Boat Builder Annual Review, 1952. London: John Trundell (Publishers), Ltd., Temple Chambers, Temple Avenue. E.C.4. Price 30s.—The *Ship and Boat Builder Annual Review*, 1952, takes the same form as the yearbook published in 1951 and is an invaluable reference book for those engaged in building or operating small craft. Included in the book are a number of directories, which refer to specific sections of the boat building industry, such as a list of builders and repair yards in Great Britain, which is repeated in the form of a geographical index, and a complementary list of overseas boat builders. Particulars of main and auxiliary marine engines produced by builders in this country and abroad are set out and followed by engine specifications of outboard motors. For those requiring aluminium alloys there is a directory of light metal stockists and a section of the book gives the various specifications of paint manufacturers. A wide range of marine fittings is listed in alphabetical order and each item is linked with the names of manufacturers, while a similar arrangement has been adopted for yard equipment and materials. The addresses of manufacturers and leading suppliers are listed separately, and there is also a directory of consultants, a list of associations, and of dock and harbour authorities throughout the world. The names of British owners of small craft are indexed, and of particular value to exporters is the directory of commercial diplomatic officers and trade commissioners, maintained by Her Majesty's Government, and the addresses of the British Chambers of Commerce. Throughout the book are short articles dealing with subjects connected with small craft, the motor coaster is discussed and trawler development reviewed, while composite construction and the building of sailing yachts are generally considered. Rubber in ship and boat building forms the subject of another article, and there are notes upon the progress of aluminium, spray painting and marine equipment. The question of builders' and repairers' lien is reviewed by a legal expert.

The Royal Show at Newton Abbot

No. I

THE Royal Agricultural Society's annual show will open at Newton Abbot on Tuesday next, July 1st, and will continue until Friday, July 4th. It will be the first occasion for over sixty years that the "Royal" has been held in Devonshire, the last time being at Plymouth in 1890. In the earlier years of the Society's life, shows were staged at Exeter in 1850 and at Plymouth in 1865. Next week's "Royal," therefore, will be the fourth to take place in Devonshire, and the first to be held in the neighbourhood of Newton Abbot. At the Exeter show in 1850, there were over 1000 implements exhibited, and four times that number when the show visited Plymouth in 1865. When the "Royal" returned to Plymouth in 1890, the implements exhibited totalled 4143, and there were ninety-five entries for the Royal Agricultural Society's silver medal for new implements. But only three medals were awarded, the successful machines being a butter-maker, a disintegrator and a horse rake. On the same occasion, a competition for cider-making plant best suited for use on a farm attracted nine entries.

The site of this year's show is at Stover Park, near Newton Abbot, and covers an area of 117 acres, compared with 150 acres at Cambridge last year. More than half the area occupied by the show this year will be required for the 570 trade stands, on the majority of which there will be exhibited farm machinery and equipment. Eight machines—including three deferred from last year's show—have been accepted for final judging for silver medals awarded for new implements. Particular interest this year will undoubtedly attach to the root harvesting implements which are to be shown, in view of the potato harvesting machinery trials which are to be carried out in the autumn by the Royal Agricultural Society. The twenty-five machines which will take part in these trials include five from Continental countries.

Although in recent years the Royal Show has become more and more indicative of the progress of mechanised agriculture, the livestock entries have lost none of their importance. On that account, there is keen disappointment that the Royal Agricultural Society has been compelled to cancel the cloven-hoofed livestock classes this year, on account of the prevalence of foot and mouth disease. Only once before in the history of the "Royal"—at Doncaster in 1912—has such a step been necessary. The decision about this year's cancellation was taken on June 10th after full consultation with veterinary experts and the Ministry of Agriculture. The decision is unquestionably a wise one in view of the toll that the disease has already taken in this country in recent months. Engineers, in company with the rest of the community, sympathise with the Society and with the cattle raisers who intended to exhibit, that the show must be deprived of so important a section. The Society is to be congratulated upon the excellent arrangements it has quickly made to compensate for the omission of the cattle. For the most part they have a distinctly mechanical flavour! They include tractor-driving competitions, demonstrations showing the full scope of cultivations by tractor-mounted implements, a display of old implements, and a parade of veteran tractors—some of them, we are informed, being forty years old. In addition, about thirty manufacturers in Devon are combining to give a comprehensive display of the county's post-war engineering achievements, particularly in agriculture and forestry.

Next week's show is to be held under the presidency of Earl Fortescue, and next Wednesday, July 2nd, the "Royal" is to be honoured by a visit of Her Majesty The Queen, who will be accompanied by H.R.H. The Duke of Edinburgh.

Below we begin descriptions of some of the machinery and implements which will be on view throughout each day of the show.

Ford Motor Company, Ltd.

The exhibits of the Ford Motor Company, Ltd., Dagenham, Essex, are being arranged primarily around the "New Fordson Major" tractor, which went into production towards the end of last year, and which was described in our issue of November 30, 1951. At the same time visitors to the show will have an opportunity of assessing the development of this firm's tractor design, as a "Fordson" built in 1917 will be included in the exhibit. This tractor is representative of those made by the Ford Company during and immediately following the first world war—before the day of the power take-off and hydraulic lift—and is similar in essential details to that illustrated in Fig. 1. The tractor has a four-cylinder engine, 4in diameter and 5in stroke, the rated horsepower being quoted as 22. The cylinders are cast integral with the top half of the crankcase, the radiator being mounted upon an extension of the crankcase. The power is taken through a multiple disc plate, which has nine driving and ten driven plates, and the final drive is by underneath worm, the bevel differential gear being carried within the centre of the wormwheel. In the 1917 tractor there was provision for three forward speeds of 1½ m.p.h., 2¾ m.p.h. and 6¾ m.p.h. and a reverse speed of 2½ m.p.h. Provision could also be made for a belt driving pulley to be mounted on the offside of the tractor. It ought to be added that there were no springs or brakes on the tractor.

Fig. 1—Tractor of 1917—Ford

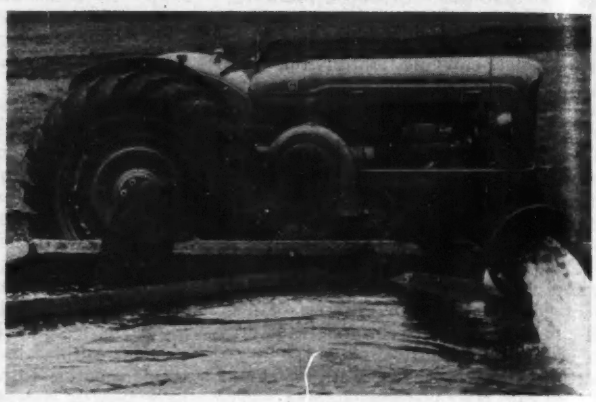


Fig. 2—"New Major" Tractor—Ford

Fig. 2 illustrates the "New Fordson Major" operating a "Sigman" pump, which is one of the many items of equipment specially produced for use with the tractor. It will be recalled that with the "New Major" there is offered a choice of three engines—diesel, petrol and vapourising oil—in each of which use has been made of components common to all three. The engines are four-cylinder, overhead valve units with replaceable wet cylinder liners and forced-feed lubrication. In all three engines the cylinder dimensions are the same, namely, 100mm bore and 115mm stroke. The transmission system of the tractor gives six forward speeds, ranging from 2·07 m.p.h. to 13·16 m.p.h., and two reverse speeds of 5·03 m.p.h. and 2·80 m.p.h. The power is transmitted through an 11in diameter, single dry plate clutch to the gearbox, through the crown wheel and pinion to the final drive. The power take-off of the tractor is fitted with a centrally placed 1⅜in diameter six-splined shaft, its speed being 542 r.p.m., with the engine running at 1200 r.p.m. There is also a two-speed belt pulley fitted at the right-hand side of the transmission housing. All the versions of the new tractor—including the half-track and full-track models—will be on show, as well as a selection of the ploughs, cultivators, loaders and other mounted implements arranged for operation with it.

The "Sigman" pump, which is shown attached to the tractor in Fig. 2, is the result of co-operation between the Ford Motor Company, Ltd., and Sigmund Pumps, Ltd. The pump has 8in suction and 6in delivery branches and gives a maximum output of 1400 gallons a minute against a head of 20ft. The pump impeller fits directly on to the tractor pulley shaft, and is supported by the pulley shaft bearings, the casing being fitted to the pulley

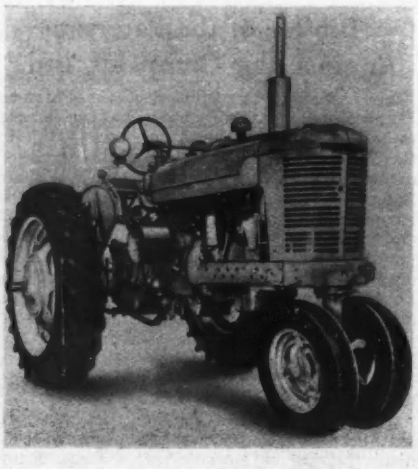


Fig. 3—Tractor with Variable Tread Front Wheel—International Harvester

shaft housing. The additional support given by a stabilising bracket allows the tractor to be moved to new positions without detaching the pump. In producing this pump the requirements of overseas users have been kept specially in mind.

International Harvester Company of Great Britain, Ltd.

One of the principal exhibits of International Harvester Company of Great Britain, Ltd., 259, City Road, London, E.C.1, will be the "Farmall BM" tractor, with a variable-tread front wheel attachment, which is now in production at the firm's Doncaster factory. The tractor, which is fitted with a four-cylinder engine, running on tractor vapourising oil, has a maximum drawbar horsepower of 32·86, provision being made for four forward speeds, when on field work, between 2¾ and 5½ m.p.h. The new front wheel arrangement, which is illustrated in Fig. 3, consists of twin pneumatic wheels with 6·00 by 16 four-ply tyres, the stub axle being set at an angle in the centre bolster so that the wheels incline inwards. The variation in tread is obtained by altering the position of the rim on the wheel.

The firm will also show a selection of the implements which it manufactures, among them being the "B-45" pick-up baler illustrated by Fig. 4. In designing this implement, the needs of the smaller farmer who may decide to mechanise hay and straw harvesting operations have been kept specially in mind. The driver of the tractor to which the baler is attached is the only man required for its operation. The pick-up cylinder, which can be seen in the illustration, has individually mounted teeth and can be driven from the ground wheel or from the power take-off of the tractor. A spring-loaded cover sheet over the pick-up cylinder prevents material from being blown off. The gathered material passes first to a floating auger, which is driven by a vee-belt, and thence to the 14in by 18in baling chamber. The plunger has a stroke of 28in and carries a knife for slicing the baled material. The weight and density of the bales can be controlled by two crank handles and adjusting screws fitted at the rear of the chamber, and two automatic knotters tie the packed bales. The main drive is taken from the power take-off shaft of the tractor, equipped with two universal joints, through spiral bevel gear transmission. A flywheel with friction drive assembly protects the baler from overload. The overall length of the baler is 18ft 1in, its width 8ft 9in, and the width of the pick-up cylinder 4ft 4in.

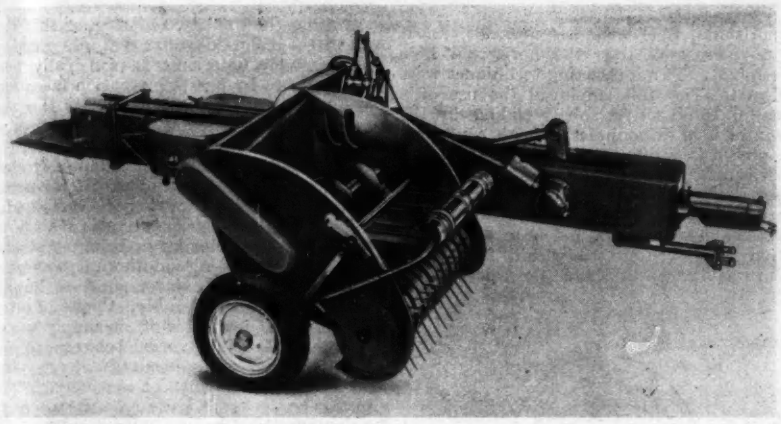


Fig. 4—Pick-up Baler—International Harvester

Other implements to be shown on this firm's stand are a "McCormick International" B-200 manure spreader and a three-furrow mounted plough. The manure spreader is equipped with self-cleaning tapered beater teeth for shredding the material as it is distributed. The actual distribution is effected by a two-piece "spiral," which is geared to suit the tractor speeds. The sides of the implement are constructed from heavy gauge, rust-resisting steel, and are reinforced with angle iron to give additional rigidity. The mounted plough is designed for working with most three-point linkage tractors and is adjustable for width with beam spacings of 10in, 11in and 12in. The front furrow width can be adjusted from the tractor seat by a winding handle and depth control is similarly adjustable by a winding handle, and can be maintained at the selected position by a spoked land-wheel carried on a heat-treated axle. The between beam braces of the plough extend downward round the curve of the beams, thus reinforcing them at the point subject to the greatest ploughing forces.

Ransomes, Sims and Jefferies, Ltd.

As is usual at the Royal Show, the exhibits of Ransomes, Sims and Jefferies, Ltd., Ipswich, will be displayed on two stands, one of them devoted to lawn mowers, and the other to implements and farm machinery. Among the mowers there is to be shown the tractor-mounted triple-gang machine, which is illustrated in Fig. 5. The three cutting units are of the firm's "Sportcutter" design, the total cutting width being 7ft 2in. The mower is considered to be specially suitable for cutting public parks, roadside verges and other stretches which may be intersected by roads and kerbed pathways. Such obstacles can be crossed with the cutters raised. Each unit has a cutting cylinder, 8in in diameter by 30in wide, running on ball bearings in dust-proof housings. The six spiral cutters are welded into steel collars, the cutters and bottom blades having keen edges of hardened steel with a tough wrought iron backing. The cylinder, which is geared to give thirty-four cuts every yard of travel, is driven at both ends through hardened steel machine-cut gears, a differential drive by pawl and ratchet allowing easy turning without skidding. Separate clutches are fitted to each drive for disengaging the cutting cylinder when the mower is transported. The two wheels of each unit are equipped with 18in by 4in pneumatic tyres, and a spring-loaded one-piece steel back roll prevents bouncing on rough ground. Rapid adjustment of the bottom blade in relation to the cutting cylinder can be made by thumb screws and the height of cut can be set from ⅛in to 2in. The main frame, to which the units are hitched, is a tubular steel structure coupled by quick release pins to the standard three-point linkage of a tractor. The individual units can be lifted by levers and when raised a lifting gear locks the frame and prevents side sway. The makers say that when dealing with smooth, level areas, the triple-gang mower will cut six acres an hour at a tractor speed of 10 m.p.h.

Among the implements to be shown by Ransomes, Sims and Jefferies, Ltd., is the "Polydisc" plough, with attachments for seeding and fertilising, illustrated by Fig. 6. This implement normally has twelve discs carried on a rotary steel shaft, which is clamped to the beam of the plough by steel hangers. The discs are made of high tensile steel, are 22in diameter and are spaced 9in apart. An adjustable rear wheel steadies the implement and assists a correct line of draught, and there is a webbed land wheel which facilitates traction under muddy or sandy conditions. The rear of the plough is swivel-mounted and the overall width of cultivation can be increased or reduced by means of a turnbuckle. Thus, when the going is soft or sticky, or when disc ploughing heavy stubble, this adjustment enables increased clearance between the discs

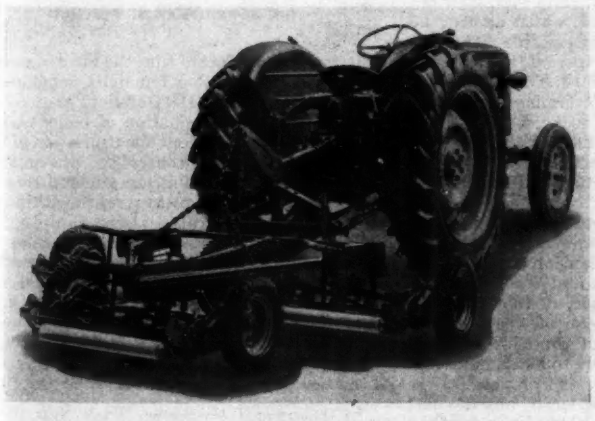


Fig. 5—Mounted Gang Mower—Ransomes

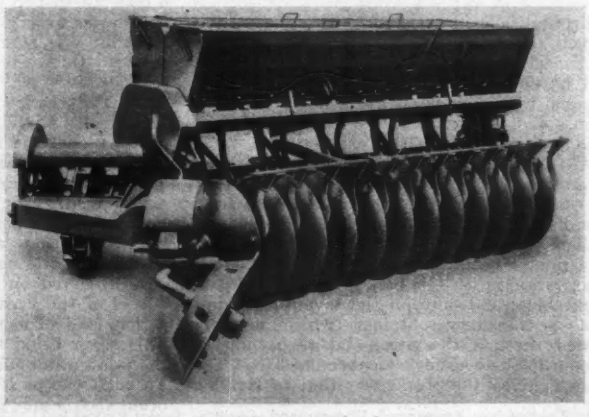


Fig. 6—Disc Plough with Seeding Attachment—Ransomes

and it also enables variation in spacing between the rows when seeding. An adjusting screw controls the working depth between 2in and 6in. The seed and fertiliser hoppers, which are of all-metal construction, are mounted above the frame of the plough, their capacities—in the case of the twelve-disc implement—being 5·5 and 6 bushels respectively. The seed drill has a fluted-roller force-feed mechanism, two gear changes, in conjunction with the lateral adjustment of the feed rollers, giving sufficient range for most seeds. There is also a reversing gear for use when sowing very small seeds. A spring controlled feed plate under the feed roller of the drill prevents the cracking of large seeds and each feed cup is provided with a shut-off slide so that any cup may be closed independently of the others. This arrangement is, of course, particularly useful when wider rows are required or when it is desirable to shut off part of the drill for finishing a field. For the fertiliser distributor there is a star wheel feed mechanism, each feed unit being easily removable for cleaning. The drive to the feed mechanism of both seeder and fertiliser is through a chain-driven sprocket operating from a clutch on the land wheel of the implement.

(To be continued)

The Underground Gasification Project

WE were recently able to join the Manchester Geological and Mining Society on the occasion of its visit to the Newman Spinney opencast workings. This rather remote site on the Fox Earth and Furnace seams in Yorkshire has been the scene of some vital experiments which, in this country at least, will determine whether the underground gasification of coal, not otherwise worth exploiting, can prove an economic proposition.

Many are the problems which have arisen with what appeared a basically simple operation of lighting a coal seam underground and collecting the products of combustion. These problems may vary fundamentally from site to site and may or may not depend on the scale of the operation. Once started it was not known what the nature of the reaction would be, how it would be affected by underground agencies, particularly water, nor how it could be best stimulated or influenced from above. Inspection being most often ruled out, there were uncertain factors and conflicting theories.

The experiments, which were initiated by the Ministry of Fuel and Power, began in 1949 on a very modest scale and with what appeared the simplest possible system of initiating combustion, sustaining it with air, and collecting the effluent gases. This seam was chosen as it promised an easy access by virtue of its exposure on one face by recent opencast workings, and it was a particularly wet and dirty seam.

The system involved two vertical bore-holes fairly closely spaced, connected by a nearly horizontal hole in the seam. Our illustration depicts the actual "U" tube formed, and the geological formations at Newman Spinney. It will be noted that the Fox Earth seam was exposed by the opencast operations which had been abandoned when the overburden reached 60ft, and it was from this exposed face, 250ft away from the nearest vertical hole that the horizontal hole was started. The site work involved in this first Northern system has been fully described by the N.C.B. site superintendent,* drilling problems of the first magnitude being encountered. It was found that a 3½in. drill pipe working with 4¾in rock roller bit described a parabola, and only on the seventh attempt was a trajectory obtained which actually passed through the seam and then only to remain in the coal for a distance of 37ft. The next significant problem was that of striking the horizontal hole with the verticals, for it was not expected that the horizontal hole was straight. Two interesting techniques were developed. The first employed the use of a source of radio-active cobalt sliding in the horizontal hole in conjunction with a probing unit, placed in a pilot vertical hole, consisting primarily of two Geiger counters. The cobalt was screened so that it could only "see" in one direction, which could be controlled. After suitable calibration tests had been completed, location was accurate to within 2in. This system was devised by the Anglo-American Oil Company, Ltd. The other method, devised by the Post Office engineers, employed an electro-magnet, in place of the cobalt, used in conjunction with a compass having remote indication placed in the vertical hole. Other holes were drilled on each side of this section, in which were placed "Hi Lift" pumps for draining the system.

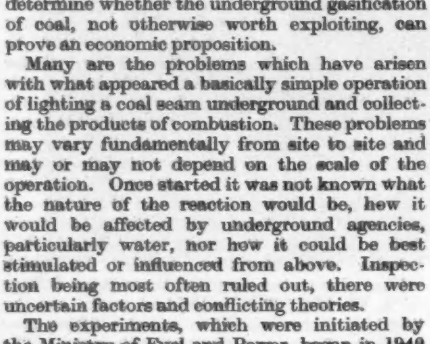


FIG. 1—FIRST SCHEME AND SITE STRATA

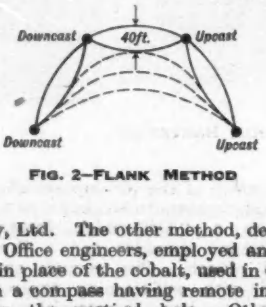


FIG. 2—FLANK METHOD

The source of ignition needed to be a relightable one from the surface and capable not only of evaporating the 50 gallons per hour water entering, but of heating up the coal to combustion temperature. The flame had also to be stable under pressure. The burner eventually adopted was one employing a hot-wire element exposed before a "Calor" flame fed from the surface. During 1950, before it was abandoned, this Northern system gasified some 200 tons of coal. It was assumed that the burnt out area was roughly elliptical and the minor axis about 40ft. It is, however, possible that the hydrostatic gradient influences the symmetry of the burnt-out area, and might in some cases produce a crescent-shaped passage. The thermal yield as gas was over 30 per cent, whilst another 25 per cent was recovered as sensible heat and steam. Over the whole period the average calorific value (C.V.) was 50 B.Th.U. per cubic foot. The reaction which determines the nature and quality of the energy recovered is a fairly complex one, and is governed by the changing contours of the reaction face as well as by the ingress of water and direction and quantity of air supplied.

This initial experiment afforded much useful information on such parameters, amongst them being the use of steam on the reaction. Also observed on this limited scale were the effects of the vacated space, of roof falls and action, and of ash and coke on the reaction. This seam being very wet probably induced the worst water effects likely to be encountered. To what extent it is economic or practical to drain such seams is not yet clear, but the cost will probably prove prohibitive. In spite of the water, the reaction proved to be mainly of a producer nature. During the first two months before oxygen appeared in the uptakes, a typical analysis after steam (25 per cent) had been condensed was (CO_2) 14·5, (CO) 9·4, (CH) 2·4, (C_nH_m) 0·5, (H_2) 4·7, (N_2) 68·5, distillation and water gases being rarely more than 2–3 per cent. Based on an average of 11,000 cubic feet per hour at the inlet consumption averaged 1·5 tons per twenty-four hours. Examination of the fused ash recovered indicated reaction temperatures exceeding 1500 deg. Cent., although the upcast temperature averaged 500 deg. Cent., the difference in sensible heat being due to the boiling of underground water, which amounted to about 15 to 20 gallons per hour. The pumps themselves withdrew initially 200 g.p.h., this falling later to 50 g.p.h. The total thermal yield averaged about 67 per cent, being constituted by about 11 therms per hour as combustible gas, 2¼ therms as sensible heat, and 1¼ therms as steam.

During the final two months of this experiment the calorific value and gas production progressively deteriorated, principally because air began to by-pass the reaction faces and up to 10 per cent oxygen appeared in the gas offtake. The proportion of sensible heat rose rapidly and excessive upcast temperatures were experienced. Measures were adopted to stabilise the reaction or to reduce the exit temperature, but their efficacy was not sustained.

These included cyclic reversals of air flow and water injection, this latter being to steam the reaction which, being endothermic, was expected not only to cool the exit temperature, but also to raise the C.V. considerably. Cycles of alternating high and low rates of air supply were also adopted. The C.V. varied between 15 and 74 B.Th.U., and the percentage steam between 15 and 60 per cent. Eventually, with the upcast badly burnt, little more than steam was being generated.†

Perhaps the most important fact revealed by this exhausted experiment was the need to re-route the air supply and, hence, the reaction front when the burnt-out area became such a size as to allow by-passing of the reaction zone by the air supply. This requirement was necessary to produce any yield at all.

But for commercial operation it was even more important so to advance or extend the reaction zone in a seam that the ratio of sensible heat to calorific value remained substantially constant; this being an obvious requirement for the proper determination of boiler and gas turbine size and the economic utilisation of their capacities. Whilst control of the reaction mechanism is still being investigated, it is, of course, not possible yet to predict within what limits that choice of ratio exists.

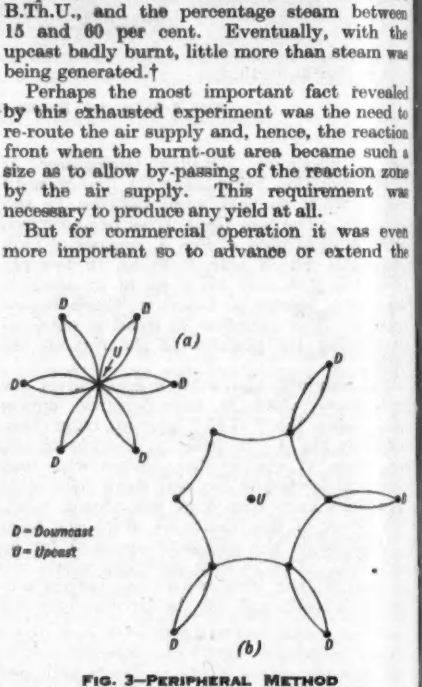


FIG. 3—PERIPHERAL METHOD

With this requirement in mind, schemes were evolved in which the expanding network of uptakes and downtakes and horizontal ways required involved a minimum of drilling and boring. For this item of expenditure alone was of the order most likely to prohibit the gasification of coal underground.

Although horizontal boring was used on the

* "Engineering Aspects of Underground Gasification," by A. S. Plane, B.Sc., Institution of Mining Engineers, June 7, 1951.

† "Underground Gasification Trials Near Chesterfield," by C. A. Masterman, *Journal* of the Institute of Fuel, January and March, 1951.

Northern site, it was never seriously considered as a commercial method on account of its high cost.

Of the several ways which are being investigated for establishing the initial and subsequent horizontal passages between each uptake and downtake, perhaps the most elegant technique is that first tried out by Mr. Masterman, technical director of Gasification Projects, at Newton Spinney. It was found by experiments carried out that by passing air down a sealed shaft communicating with the seam at a pressure sufficient to lift the overburden, some of it could be recovered via another vertical shaft some distance away, having presumably split the strata at or near coal level. Consequently, by lighting the seam at the downtake, the reaction was encouraged to progress to the uptake and thus burn its own gallery. On completion of this process low-pressure air (5 lb per square inch) sufficed to maintain the reaction. However, of the high-pressure air only about one-third actually passed in the right direction, the remainder being dissipated in all other directions and gasifying coal which did not contribute to the creation of the gallery. It took some three weeks to establish this first passage 37ft long. To improve the efficiency of this method several techniques have been employed to make the air flow in a preferential direction. Another and current approach relates to the use of oxygen to accelerate the burning through process and thus reduce the high-pressure pumping time.

The following year, in 1951, two more holes were sunk 75ft apart and connected by high-pressure linkage. This site was operated until air began to by-pass the reaction zones again, whereupon two further holes were sunk on the flank 12ft distance, as shown in our diagram (Fig. 2) and connected by high-pressure linkage. By delivering air through one of these flank holes and recovering gas from the other, it is hoped to cause the air to traverse the old combustion face and to advance the zone progressively as shown by the dotted lines. Two further holes have now been sunk 30ft away and the investigation is still in progress.

Meanwhile, another pilot system has been prepared. As is shown in our other diagram (Fig. 3), it consists of six vertical holes drilled this time into the Furnace seam, 170ft deep at 50ft spacing. These holes are now being connected radially to a central hole by this high-pressure burning technique. During this process the central hole is acting as a downtake and the radial holes, with a fire at each are acting as uptakes. For the present experiment, the duties of these holes will be reversed on completion of the burning out process. When the burnt-out area assumes the hexagon as shown, further radial extensions are envisaged as shown dotted. It is hoped to gasify up to 25 tons per day at this site and plant to utilise some of the energy has been ordered.

These are only some of the methods by which it is hoped to control and direct the reaction fronts through a seam to maintain a constant gas quality according to the nature of the energy required. Similar trials are now also in hand at Bayton, Worcestershire, where it is also intended to open up an extinct gasification site for inspection.

Civil Engineering in the Colonies

LAST week the Institution of Civil Engineers held the third in its series of conferences on civil engineering problems in the Colonies. These conferences are held every two years at about this time, instead of the usual summer meeting. This year the conference was well attended, and the proceedings included technical sessions, during which seven papers were presented for discussion, and a number of visits to places of engineering interest. The conference was opened by Mr. Oliver Lyttelton, Secretary of State for the Colonies, on Monday, June 16th. That evening, the delegates were invited to a reception at Lancaster House, where Mr. Lyttelton welcomed them. The week's events also included the Institution's conversazione, as is noted on another page of this issue.

A number of problems which, it seems, are common to the Colonies generally, were made clear from the technical sessions of the conferences. Probably the greatest single obstacle to development is the shortage of trained engineering staff; another problem which makes the basic development of water resources very difficult, whether it is for drinking water, irrigation, or power, is the lack of hydrological data. A good idea of the many other difficulties which must be overcome in developing the Colonies may be obtained from a perusal of the various papers.

Road Research.—The first paper of the conference was entitled "The Need for Colonial Road Research," and was by H. W. W. Pollitt. The author set out the many problems, both technical and economic, where more detailed knowledge was required. The kind of road which could be justified economically in given circumstances was the first problem to be solved, he thought, and there was clearly need for research on the relation between the cost of the road and the cost of transport on it. The design of the road was complicated by lack of knowledge of the effect of moisture content on soil behaviour, under colonial conditions, and of the effect of traffic intensity. Other problems which had to be solved concerned the availability of materials, the possibilities of mechanical stabilisation and the use of indigenous materials; widths and thicknesses of road formations and the properties of bituminous binders were also commented upon. In the author's opinion, as much as possible of this research should be carried out in a central African laboratory.

HUNYANI POORT DAM

Owen Falls Hydro-Electric Scheme.—"Hydro-Electric Development in Uganda," by C. R. Westlake and T. A. L. Paton, dealt mainly with the Owen Falls hydro-electric scheme, which is now under construction. The project has already been described in these columns, and an account of the progress of the work was given in our issue of December 28th last. A point of particular interest about the paper was the description of the difficulties of formulating a system of tariffs in the absence of an established demand. The scheme is remarkable for the high degree of regulation obtained from Lake Victoria, which, it was noted, is such that a fully regulated discharge from which a continuous output of 102MW could be produced at an economical cost, could be secured with a storage range of only 2m. The paper also described the construction of temporary coffer-dams, partly consisting of timber cribs, "tailor-made" to fit the configuration of the rock barrier, which constitutes one of the most difficult parts of the work.

Water Supply.—There were three papers on water supply presented to the congress, namely, "The Development of the Water Resources of Southern Rhodesia," by P. H. Haviland; "The Hong Kong Waterworks," by L. Jackson and "Development of Rural Water Supplies in Tanganyika," by L. L. R. Buckland.

Steady progress in the development of the water resources is taking place in Southern Rhodesia. Irrigation on a large scale is still in its infancy, but erosion is being checked and to-day, it was stated, there are few cases where it becomes necessary to make any marked allowance in major storage works for silting. The development of underground supplies and of the numerous small and medium storage works, often depending on earthen or rock fill dams, was described in Mr. Haviland's paper. Some notes were also given of the major storage dams of Ngesi, Unshandige and Hunyani Poort. A cross section of the latter, which is the first dam of its kind to be built in South Africa, is illustrated herewith. It stores 55,000 million gallons at the full supply level 90ft above bed, and the yield is assessed at not less than 45 m.g.d., exclusive of 5 m.g.d. of compensation water. The impervious material is a red clayey loam (about 40 per cent clay), and the rock fill is of banded ironstone. The spillway is on the right bank, with a weir 350ft long which can discharge the probable maximum flood of 72,000 cusecs with a rise in level of 14ft.

The history of the Hong Kong waterworks has been one of continual struggle to catch up with demands, which has hardly ever succeeded. The resources of the Colony are limited, but several impounding schemes have been constructed, the most recent being the Shing Mun Valley reservoir (described in THE ENGINEER of January 22, 1937, and January 7, 1938). Work on a new scheme has just been started.

The waterworks in the Colony of Hong Kong are remarkable for the extensive use of catch-water aqueducts serving the reservoirs, and for an extremely complicated distribution and purification system. Probably the most interesting technical achievement of the supply system was the construction of welded pipelines, about 6000ft long, crossing the harbour, and having a maximum depth of 64ft, in a busy area subject to tides and strong currents.

Various speakers in the discussion on Mr. Buckland's paper noted that the conditions which he described were generally typical of East, Central and West Africa, and gave a very good idea of the situation. The paper described the nature and variety of the problems of water development in Tanganyika, but did not give details of the engineering aspect. Existing permanent water supplies are widely spaced, it was noted, and the areas served by these supplies are becoming over populated. The number of cattle is increasing and over-grazing of the areas around the present waters is becoming serious from the point of view of soil erosion. More and better distributed domestic supplies were needed, he thought, to serve human and cattle requirements in the existing settled areas, as well as to open up new areas to allow for expansion.

Railways.—An interesting account of the effect on the railway in North Borneo of the Japanese occupation was given by H. Gatford in the paper "Rehabilitation of the North Borneo Railway." The methods of repair and the difficulties which were faced, both due to local conditions and enemy action, were described, and an account was given of the repair of a bridge of four spans of 100ft.

"Notes on Re-Laying and Maintenance, Nigerian Railways," by E. J. B. Gahan, described track re-laying with hardwood sleepers of local origin, in place of the steel sleepers used previously. The species of timber used, their extraction and treatment were dealt with. Another section of the paper described the development of a re-laying train using lengths of pre-assembled track which were handled into position manually. There were also sections on steel sleeper conversion (from lug to clip fastenings), and on curve correction and maintenance, and a note on organisation and training for the maintenance of permanent way.

FIREPROOF MATERIAL.—We have received from Marinite, Ltd., a brochure entitled "Marinite," which gives general particulars of the fireproof material of this name and its use as a joiner material on board ship. Details of tools required for working "Marinite" are listed and erection methods described, while many queries are dealt with by a series of questions and answers. A table of weights and thicknesses is given and a number of drawings illustrate methods of construction.

A Prestressed Concrete Bridge in Michigan

The design of the small bridge here described furnishes an interesting example of how prestressed concrete beams and girders have been constructed in the U.S., of machine-made precast I-shaped concrete blocks, which are clamped together and prestressed at the construction site. According to the designers of the bridge, it is competitive in cost under American conditions with an equivalent steelwork structure.

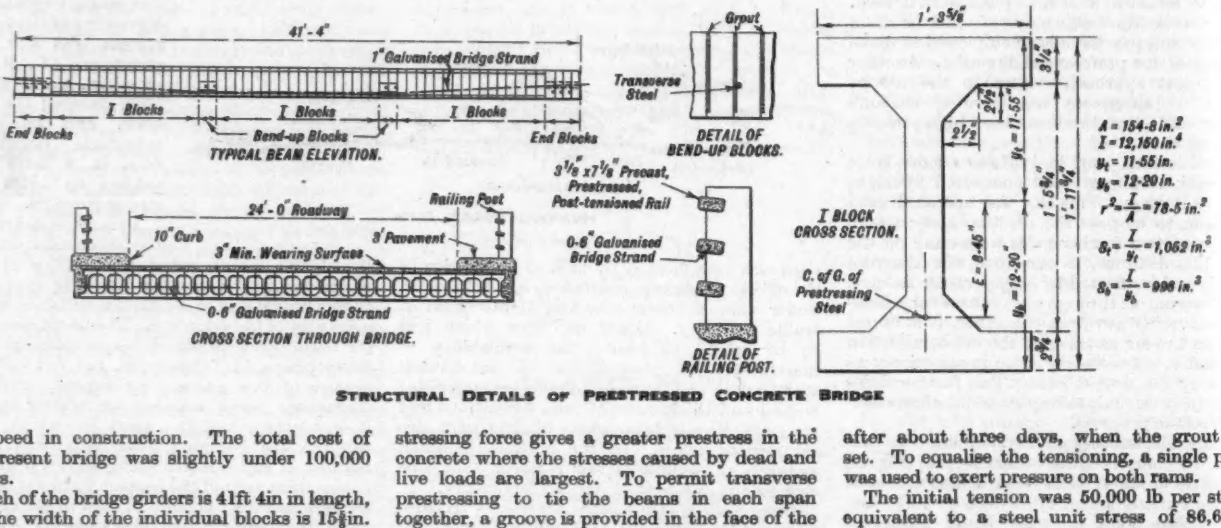
THE John R. Bridge over the Red Run Drain in Oakland County, Michigan, just north of Detroit has now been completed. This new highway bridge has a total length of 130ft, made up of three spans, and a clear roadway width of 24ft. Its substructure consists of two concrete bents and two abutments, which were cast *in situ*. It replaces a 50ft long single-span steel bridge which had to be demolished because of the widening of the Red Run channel by the U.S. Army Corps of Engineers for flood control purposes. Important reasons for the adoption of prestressed concrete construction for the bridge superstructure were the lack, at the time, of structural steel and the need for speed in construction. The total cost of the present bridge was slightly under 100,000 dollars.

Each of the bridge girders is 41ft 4in in length, and the width of the individual blocks is 15⅝in. The overall width of the bridge is 31ft 3in, with a slight overhang outside the bridge railings. Each span, therefore, is made up of twenty-four individual prestressed girders, each mounted flush against the other. All girders forming the three-span bridge were assembled from precast concrete units produced on high-speed block-making machinery, with only slight changes having to be made in the mould box. The illustration on page 869 shows the three designs of blocks which were used in the construction of the bridge girders; bend-up blocks, blocks of I-section and end blocks. The greater part of each beam consists of I-section blocks. The solid rectangular end blocks are used for the anchorages, and the solid bend-up blocks, inserted at the beam third-points, serve as positioners for the prestressing steel strands. All blocks are 23⅝in deep 15⅝in wide and 8in thick. They have a minimum compressive strength of 5000 lb per square inch. Details of the I-block section are shown below. Four end blocks, which have two holes each at mid-depth for the steel strands applying longitudinal prestress, are needed to resist the anchorage forces. Two bend-up blocks are required at each third-point to hold these strands just above the bottom flange in the central portion of the span. Sloping down from the anchorages, the strands pass through slots in the sides of the bend-up blocks. The eccentricity of the pre-stressing force gives a greater prestress in the concrete where the stresses caused by dead and live loads are largest. To permit transverse prestressing to tie the beams in each span together, a groove is provided in the face of the end and the bend-up blocks. When the blocks are assembled to form a beam, each groove becomes a hole in the beam. As the beams are positioned on the bridge, steel strands are slipped through the holes for transverse pre-stressing. One galvanised steel strand, 0·6in in diameter, and composed of twelve wires, is used for the transverse prestressing at each end of the span and at each third-point. Two galvanised steel strands are used for the longitudinal prestressing of each individual beam. The strands are 1in in diameter, and are composed of nineteen wires. A fitting is attached to each end of a strand and a threaded stud is inserted in the fitting. Turning a nut on this stud permits adjustments to be made in tension. The nut acts against an 8½in by 14in by 1½in steel plate, which distributes the prestress over the end block.

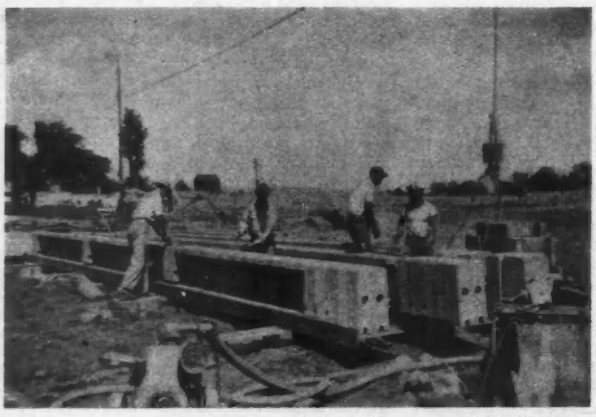
The beams were assembled near the bridge site. The blocks were laid side by side on the horizontal webs of steel joists, with the joist flanges serving as straight edges for aligning the blocks. After the blocks had been assembled, the prestressing steel was threaded through the holes in the end blocks and down through the slots in the bend-up blocks at the third-points of each girder. The prestressing strands were then tightened with a wrench, only enough tension being developed at this time to assure full contact between blocks and to maintain girder alignment. Joints between individual blocks were then filled with a rich grout, using high early strength cement, which was poured into the openings provided by a depression formed in one face of each block. The tension on the strands was then increased to approximately 5000 lb per strand. This tension was not maintained indefinitely, but was relaxed as the wet grout squeezed into irregularities in the blocks. Final tensioning by means of a pair of hydraulic jacks took place after about three days, when the grout had set. To equalise the tensioning, a single pump was used to exert pressure on both rams.

The initial tension was 50,000 lb per strand equivalent to a steel unit stress of 86,655 lb per square inch. The designers expect that plastic flow of the concrete may decrease this value to 72,790 lb per square inch. At that time the average age prestress on the beams will be 640 lb per square inch. At midspan, while carrying their own weight, these beams would then have a maximum compressive stress of 1140 lb per square inch in the bottom flange and 140 lb per square inch in the upper surface of the top flange.

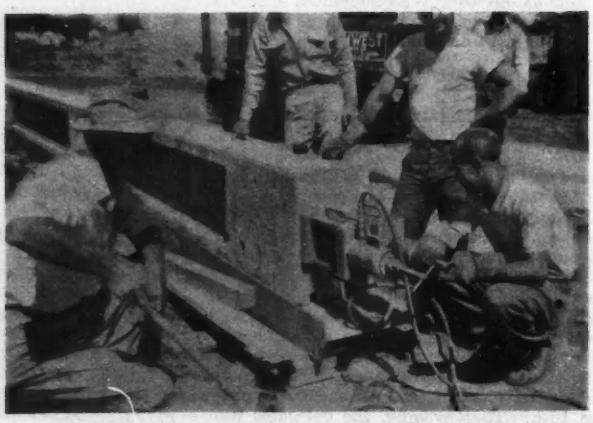
Under the full prestress, the block beams, which weighed about four tons each, were self-supporting. They were picked up by a mobile crane and transported to the bridge, being suspended from a structural steel equaliser beam, and supported only at their ends. Transverse



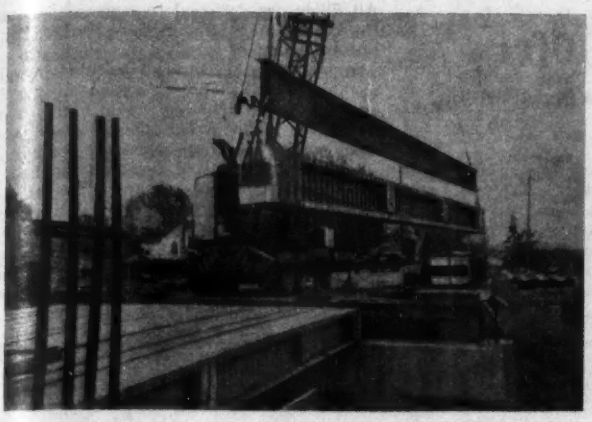
STRUCTURAL DETAILS OF PRESTRESSED CONCRETE BRIDGE



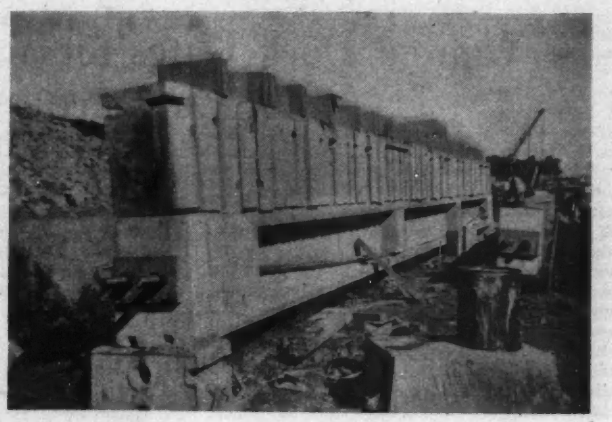
ASSEMBLY OF GIRDERS AT BRIDGE SITE



PRESTRESSING OF GIRDER



EMPLACEMENT OF CENTRE SPAN GIRDER

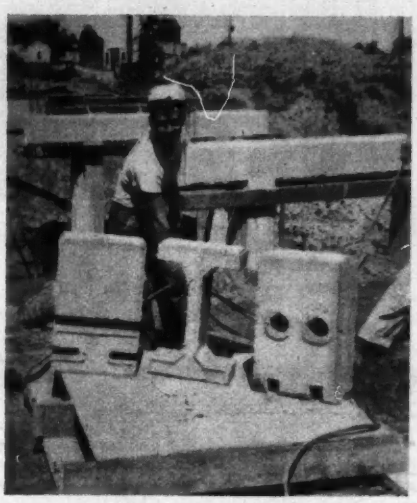


TEST LOAD ON GIRDER

prestressing cables were threaded through the beams as they were erected. After each span was in position, a 3in minimum concrete wearing surface and two 3ft wide sidewalks were poured over it. When this slab had cured sufficiently, each of the transverse strands was tensioned to 27,000 lb with a ram.

In the design of the prestressed girders for the bridge, the two longitudinal prestressing strands were each considered to have a tensioning capacity of 72,000 lb, and a design capacity of 60,500 lb. By assuming tensions of 50,000 lb to be set up in each of the two strands, and allowing for a 16 per cent loss in tension due to plastic flow and shrinkage of concrete, the remaining total prestress of 84,000 lb was the amount used for design purposes. By test loading a girder 41ft long and measuring the resulting deflection, a value of 2,860,000 lb per square inch for the modulus of elasticity of the concrete was determined. Using conventional beam formulae, the deflection of the girder under the moment developed by the live load plus the impact load was found to be 0·277in, or one part in 1775. The actual measured deflection of a completed span under the design load amounted to one part in 8000, or one-tenth of the allowable. The effect of the wearing surface was neglected in all instances. This effect will be to decrease the deflection and the final concrete stresses. The extent to which it is effective depends upon the bond developed on the top face of the girders. Every effort was made to assure a good bond, both by providing irregularities in the top girder surfaces, and by the use of a rich grout broomed on the girders immediately prior to pouring the wearing surface. Assuming a constant value for the moment of inertia of the girder and taking the ultimate tensile strength of the steel at 220,000 lb per square inch, the compressive force in the top fibre of the concrete was determined to be 4430 lb per square inch. Under those conditions, a loading equivalent to the total dead load, plus 10·2 times the design live load, would stress the steel to its ultimate tensile strength.

The John R. Bridge was designed by Johnson and Anderson, consulting engineers of Pontiac, Michigan. It was built for the Red Run Drainage Board by L. A. Davidson, contractors, of Lansing, Michigan. The concrete blocks were supplied by the Standard Building Products Company, of Detroit, and the steel strands were furnished by John A. Roebling's Sons Company, of Trenton, New Jersey.

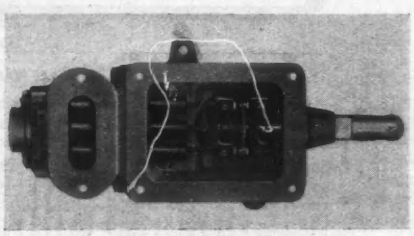


PRECAST BRIDGE BLOCKS

THE COMPLETED BRIDGE

Flameproof Limit Switch

THE accompanying illustration shows the interior construction (with covers removed) of a flameproof limit switch, type "LM1," made by Siemens-Schuckert (Great Britain), Ltd., Great West Road, Brentford, Middlesex. This switch is built to satisfy flameproof requirements for Group I and Group II gases and is certified under the numbers FLP 2912 and FLP 2913. It consists of a double-break single-pole switch with two normally open and two normally closed contacts, enclosed in a substantial casing made of aluminium alloy with a large cover giving easy access to the interior. One end of the enclosure carries a boss, through which slides a large-diameter operating plunger with a roller at the end to give a smooth action. The other end of the enclosure takes a compound-filled cable gland for wire armoured cable up to ¾in diameter under armour or a gland to take up to ¾in conduit. At the gland end the enclosure carries a three-way moulding



FLAMEPROOF LIMIT SWITCH WITH COVERS REMOVED

with socket inserts. A similar moulding is fitted into the gland and the sockets are connected by contact pins. This "plug-in" terminal construction allows the gland to be readily mounted on or removed from the switch enclosure without the necessity of disturbing any electrical connections. Apart from its use as an automatic start and stop switch, it may be applied to remote indication, either visual or audible. Substitution of a handle for the roller and a small internal modification can make the limit switch suitable for use as a flameproof signalling switch.

The dimensions of the switch enclosure itself are approximately 6in by 4in by 3in and the overall length of the switch including operating plunger and cable gland is approximately 17in with gland for armoured cable, and 16in. with gland for conduit.

PAPUA OIL PROGRAMME.—The future oil exploration programme in Papua is being considered by the Australasian Petroleum Company. In the meanwhile the search for oil has been intensified and an additional geophysical survey party has been sent out.

Welded Dock Gates for a 100ft River Entrance

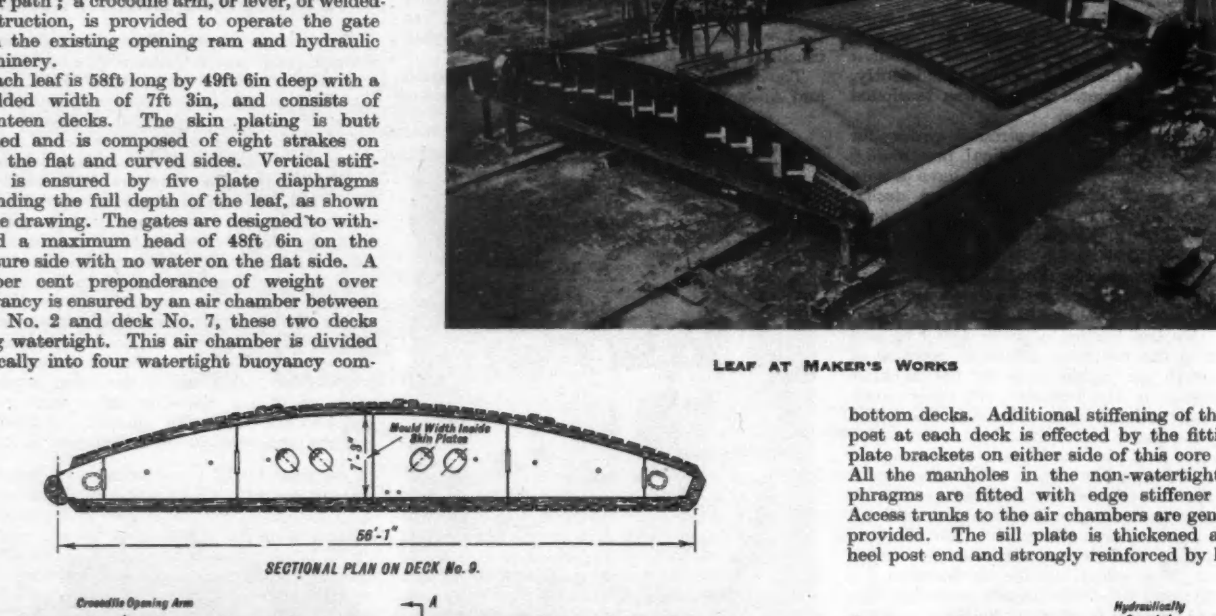
A PAIR of welded dock gates has recently been installed at the King George V dock of the Port of London Authority. The gates were launched at the works of the makers, Head Wrightson and Co., Ltd., at Thornaby-on-Tees, and towed to the Thames and stepped into position by floating crane. They have been designed to be interchangeable to any of the three positions at the entrance lock of the King George V dock. Details of a leaf are shown in the accompanying drawing, whilst the second illustration shows a leaf prior to launching. The makers state that the weight of a leaf is 240 tons, but that a similar riveted leaf would have weighed about 350 tons.

The gates are of buoyant tank design, but rollers have been fitted to suit the existing roller path; a crocodile arm, or lever, of welded construction, is provided to operate the gate from the existing opening ram and hydraulic machinery.

Each leaf is 58ft long by 49ft 6in deep with a moulded width of 7ft 3in, and consists of seventeen decks. The skin plating is butt jointed and is composed of eight strakes on both the flat and curved sides. Vertical stiffness is ensured by five plate diaphragms extending the full depth of the leaf, as shown in the drawing. The gates are designed to withstand a maximum head of 48ft 6in on the pressure side with no water on the flat side. A 10 per cent preponderance of weight over buoyancy is ensured by an air chamber between deck No. 2 and deck No. 7, these two decks being watertight. This air chamber is divided vertically into four watertight buoyancy compartments by the diaphragms. The ballast chambers are between decks 1 and 2, and 7 and 17. The centre diaphragm is watertight for the full depth of the leaf, so that two tanks are formed in the upper tidal chamber; the ballast chambers between the first deck and second deck are tidal on the pressure side.

All fillets are designed to transmit adequately the horizontal shear stresses produced by the normal shear at the various decks and diaphragms. The decks are fabricated from mild steel plates and each deck is made in two pieces and butt jointed before profile burning. Skin plating is made in two pieces laterally, with each strake spanning two deck spaces. The deck plates are fitted between the heel and mitre post steelwork and angles are welded to each deck between the skin plates to give additional web stiffening. The heel post and mitre post are built up from 1in thick plates, a central core plate, 1in thick, extending for the full length of the heel post between the top and bottom decks. Additional stiffening of the heel post at each deck is effected by the fitting of plate brackets on either side of this core plate. All the manholes in the non-watertight diaphragms are fitted with edge stiffener flats. Access trunks to the air chambers are generally provided. The sill plate is thickened at the heel post end and strongly reinforced by heavy

LEAF AT MAKER'S WORKS



GENERAL ARRANGEMENT OF DOCK GATES

ribs to take 1¼in thick plate forming the platform for the bottom gudgeon casting.

The bottom heel post gudgeon is of cast steel, machined on the base and in the bore, spigoted into a heavy doubling plate and secured by turned bolts. A carbon steel wearing pad is included, and the whole designed to fit the existing pintle. The top heel post gudgeon is of cast steel, machined on the base and bearing diameter, spigoted and attached to the top deck by turned bolts through a heavy doubling plate, and was also arranged to suit the existing anchorage.

The heel posts, mitre posts and sill pieces are of selected greenheart, securely bolted to the main frame of the gate. All bolt heads are sunk deep enough into the timber to allow greenheart plugs to be inserted. Each heel post is made in four pieces, the length being divided into two and the section into two, so ensuring sound timber throughout. Each mitre post is also made in four corresponding pieces. All butt joints in the timber are staggered. Elm fendering is provided on both curved and flat sides of the leaf extending from the top platform to a distance of approximately 26ft below the top deck. The waling timbers are attached to the gate by welded cleats attached to the skin plating, two bolts being used at each point of support. The sheathing timbers are attached to the horizontal walings by spikes.

Three hydraulically operated sluices are provided on each leaf, each with a clear opening of 3ft 5in by 2ft 11in. The sluice door is in cast iron and the guide frame in cast steel with gunmetal faces. Adjustable wedge pieces are provided to the door and frame, and an adjustable stop is fitted in the bottom of the frame. Six cast iron, gun metal bushed guide brackets are fitted to take the steel extension spindle. The hydraulic cylinder is in cast iron, 7in diameter, with a bronze lining and a high tensile brass piston-rod and gunmetal piston plates. It is suitable for a hydraulic supply of 750 lb per square inch. The bottom end of the spear rod is connected directly to the sluice door, in accordance with the general practice for large sluices and heavy loads.

The crocodile opening lever, which is shown in the elevation of the gate, is of welded construction. It was designed to suit the existing anchorage and to take the existing ram connection. Two cast steel side plates are situated one on each side of the web at the anchorage pin to the existing ram. The opening lever complete with pin was delivered separately and fitted to the gate after erection at the site.

The Annual Report of the National Physical Laboratory

THE annual report of the National Physical Laboratory for the year 1951 was published on Tuesday last week. It notes an important change during the year with the transfer of most of the Engineering Division to the Mechanical Engineering Research Organisation at East Kilbride. Work in the Aerodynamics Division was largely directed to problems arising with high-speed aircraft. Very important work was in progress on delta and swept wings, and mention is made of work in connection with suction boundary layer control using porous wing surfaces. A catalogue has been prepared giving details of all aerofoil sections which have been designed at the N.P.L. Amongst work in the Electricity Division mention is made of two determinations of the ohm by reference to the primary standard of mutual inductance and frequency which agreed to within one part in a million. In the Light Division an instrument has been developed for camouflage work which measures the colour of distant objects. Other work included the development of new methods of producing and copying diffraction gratings. Further details are given in the report of the work carried out by the automatic computing engine section of the Mathematics Division, and teething troubles of the A.C.E. machine are described. The work of the Physics Division included noise measurement, and research on hearing aids and tests for radium deposited in the human body.

American Engineering News

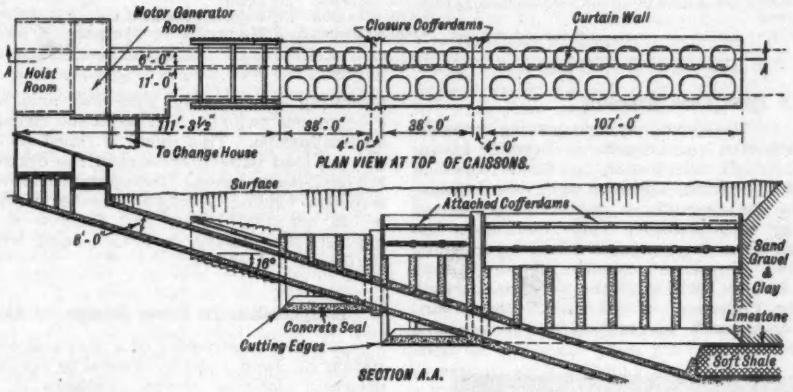
(By our American Correspondent)

Construction of a Sloped Coal Mine Entry

For a new mine near Pawnee, in Central Illinois, the Peabody Coal Company recently constructed a sloped main entry, thus facilitating the elevation of coal to the surface on a belt conveyor. To reach the coal seam at a depth of 350ft, the slope, which is pitched 16 deg. from the horizontal, is 1280ft long. The opening, which is rectangular in shape, is 8ft high and 18ft wide. In addition to the 48in belt conveyor mounted in a 6ft wide compartment, there is a single track, 11ft wide haulageway for the movement of materials and personnel. The advantages of eliminating the conventional shaft with its skips, guides, cables and consequent high maintenance and operating costs, were considered sufficient to justify the higher initial cost of a slope. The longer time required to drive the slope rather than sink a shaft, was not expected to delay the date when the mine will be in full production. This was made possible by installing temporary skips, hoist and tipple at the 15ft diameter ventilation shaft to serve as an access shaft for extensible underground development. The slope was driven upward from the coal seam as well as downward from the surface. The feasibility of the entire project depended upon the successful construction of the slope from the surface through a 65ft depth of water-bearing sand, gravel, and clay. The Peabody Coal Company awarded a contract to the Dravo Corporation of Pittsburgh to build this portion of the slope and also to sink the 350ft ventilation shaft.

The reinforced concrete-lined ventilation shaft, which is 15ft in diameter, was completed in four months. Depending upon the stability of the rock, sinking advanced below the previously poured concrete lining as much as 50ft, before lining was placed in the exposed rock section. Stub entries were driven into the coal seam and were lined with concrete. Thirty-two vertical feet of steel-liner-plate rings were placed through soft ground at the surface. Immediately upon completion of the shaft, the owner began preparations for underground development and for the driving of the slope upwards from the coal seam. The construction of the 50ft ground section of the slope involved the sinking of three reinforced concrete caissons. The first caisson, 107ft long and 28ft wide, was sunk until its cutting edge had uniform bearing upon rock. After inspecting the underlying rock from a test pit excavated beneath the caisson, a satisfactory location was selected for making the transition from open cut into tunnel construction. Working from the end wall of the caisson downwards to this point in short sections, excavation was made and the concrete floors, walls and roof of the slope poured. Using steel beams to support the rock overhead, several feet of tunnel were driven and lined with concrete. With the location of the slope thus established work on the other two caissons, each 38ft long and 26ft wide, was started. These were formed to facilitate the slope passing through them near their bottoms and, consequently, each was sunk to a predetermined level. To prevent any future settlement, a concrete seal 3ft thick was placed under each of these caissons. The three caissons were separated by 4ft spaces and, after all sinking was completed, steel sheet piles of arch-web section were driven between the corners of adjacent caissons, thus closing off the ends of the 4ft wide openings. The small cofferdams thereby formed were excavated to a depth of 3ft below the slope floor. Short beams spanning recesses were left in the caissons. Holes slightly larger than the slope were blasted through the end walls of the caissons and the concrete construction of the slope within the first caisson was extended through both smaller caissons and the closure cofferdams. From the last caisson to the surface a short section was built within steel sheets and the remainder in open cut construction. Incorporated in the portal section is a man trip loading platform and foundations for the main hoist and the motor generator set.

The design and method of building the concrete caissons was generally similar for all three. Each was rectangular in plan with the outside surfaces made as smooth and true as practicable. Steel cutting edges were provided at the bottom of, and flush with, the outside surfaces. The lower 6ft of the outside walls were wedge-shaped, the inside faces sloping upwards and inwards from the cutting edge. As a result of this shape, earth sheared off by the cutting edge as the caisson sank under its own weight was rolled towards the centre of the 6ft high "work chamber." Vertical holes—approximately 10ft in diameter and spaced evenly in the plan view—were left in the caissons. Through these holes, sixteen in the large and six in each of the smaller caissons, material was excavated from underneath the caissons by means of 1½ cubic yard clamshell buckets. The shuttering was designed and fabricated to be usable from one caisson to the next with only minor altérations. All of the caissons were formed in a 15ft deep open cut in order to reduce the height required for each caisson and to eliminate unnecessary sinking. The depth of this open cut was limited by the stability of its banks and the reach of the relatively heavy cranes which worked along the top of the banks. The height of the concrete portions of each caisson was determined by an economical balance between the volume of concrete, the area of formed surfaces, and the weight required to make the caisson sink. This was determined to be 35ft for the central and 30ft for the end caissons. For both the large and middle caissons, height above the concrete section was provided for each by an attached cofferdam. This was installed when sinking had progressed until the top of the concrete was at ground level. Each cofferdam consisted of steel beam and timber bracing within walls of steel sheet piling and was of the same outside dimensions as its caisson. These cofferdams were removed



SLOPED COAL MINE ENTRY

after the slope was constructed within the caissons and as back-filling of the caissons progressed.

Heavy Press Programme of the U.S. Air Force

The present extent of the "heavy press programme" of the U.S. Air Force has now been released officially and gives an indication of the important part which forging and extrusion facilities play within the American defence effort. While the actual construction of a 75,000-ton forging press has been abandoned for the present, contracts have been placed for the following seventeen presses :—

	Contractor	Press	User
		Tons	
1.	Mesta Machine Company	50,000, forging... ...	Aluminum Company of America
2.	United Engineering and Foundry Company ...	35,000, forging... ...	Ditto
3.	Ditto	35,000, forging... ...	Harvey Machine Company
4.	Ditto	20,000, extrusion ...	Ditto
5.	Ditto	12,000, extrusion ...	Reynolds Metals Company
6.	Baldwin-Lima-Hamilton Corporation	25,000, forging... ...	Harvey Machine Company
7.	E. W. Bliss Company	35,000, forging... ...	—
8.	Ditto	25,000, forging... ...	—
9.	Loewy Construction Company	50,000, forging... ...	Wyman-Gordon Company
10.	Ditto	35,000, forging... ...	Ditto
11.	Ditto	25,000, extrusion ...	Bohn Aluminum and Brass Corporation
12.	Ditto	20,000, extrusion ...	Aluminum Company of America
13.	Ditto	12,000, extrusion ...	Curtiss-Wright Corporation
14.	Ditto	8,000, extrusion ...	Kaiser Aluminum Corporation
15.	Ditto	8,000, extrusion ...	Ditto
16.	Ditto	8,000, extrusion ...	Reynolds Metals Company
17.	Ditto	8,000, extrusion ...	Harvey Machine Company

A Press Load Indicator

The accompanying engraving shows the "Dieometer," an interesting electronic instrument which measures the loads developed in press operations, indicates and records accurately the maximum or instantaneous tonnage during each stamping cycle and stops the press when any predetermined overloading occurs. Developed recently by the Henry and Wright Division of the Emhart Manufacturing Company, of Hartford, Connecticut, the instrument makes possible considerable

ELECTRONIC PRESS LOAD INDICATOR

improvements in metal stamping operations, and will be particularly valuable in studying the initial running of a new die in a press. It is well-known that in die work involving coining, sizing, squeezing around a boss or hub, or sharpening formed corners, pressure is built up rapidly. Frequently, a slight adjustment of the crosshead downward may be all that is necessary to produce satisfactory work. If the adjustment is exceeded and is not checked carefully, pressure may go beyond the machine capacity by 50 to 100 per cent. This condition may not be noticed by the machine operator even though he checks the product. At one works a coining operation in one step of a progressive die made proper setting of the die extremely critical. Considerable difficulty had been experienced in running the die. A check with the new instrument revealed that the loads developed by the die when properly set were well within the press capacity. In using the instrument, strain gauges, which are mounted permanently on each press guide rod, feed directly into an amplifier. The output of this amplifier actuates a thyratron valve connected to the clutch, which causes the press to be turned off instantly when it is overloaded. Operating concurrently with the unit is a synchronous switch which feeds the signal to an oscilloscope. This signal is timed so that the full load pattern appears in the centre of the oscilloscope screen. The instrument reveals eccentric loading, discloses whether work is within practical limits, and suggests a die redesign, if necessary, to bring loading within the desired boundaries.

A Hydro-Electric Power Scheme for Alaska

The construction of a dam and power station at Swan Lake in Alaska to eliminate recurring electrical energy shortages in the Ketchikan area has been recommended by the Secretary of the Interior. Engineering details of the Swan Lake project include a 184ft high dam at the lower end of Swan Lake on Falls Creek, creating a reservoir of 132,000 acre-feet water storage capacity, and the delivery of water through a penstock 9ft in diameter and 2400ft long to a power station with three generators having a total installed capacity of 13·5MW. Power would be transmitted to load centres through 31 miles of high-tension lines, with substations at Ward Cove and Ketchikan. The construction costs of the project, estimated at 13,562,000 dollars, would be repaid to the U.S. Federal Government with 2½ per cent interest in fifty years from the sale of power produced at the plant. A report on the scheme estimates that direct and indirect benefits from the project will exceed the costs by a ratio of 2·05 dollars in returns for every dollar of expenditure. The construction of the scheme is expected to take three years, and by that time the additional 71,000,000kWh of electric energy to be provided by the plant will be needed not only because of the normal steady growth of Ketchikan and its environs, but also because of the contemplated construction of a large pulp mill, which will bring in hundreds of workers and increase the service industries in the area.

PROPERTIES OF METALLIC SURFACES.—The Institute of Metals is arranging for a one-day symposium on "Properties of Metallic Surfaces," to be held at the Royal Institution, Albemarle Street, London, W.1, on Wednesday, November 19th, from 9.45 a.m. to 5 p.m. Attendance at the meeting will be free to all who are interested in the subject. Non-members of the Institute who wish to register for the meeting should apply to the Secretary of the Institute of Metals, 4, Grosvenor Gardens, London S.W.1, to receive the programme and registration form, which will be available in August.

French Engineering News

(By our French Correspondent)

It is reported that in 1951 iron ore production increased by 17 per cent in France. The figures announced are 35,266,054 tons, against 29,989,904 tons in 1950. Production in 1951 was 69·7 per cent greater than 1929 and 106·7 per cent greater than in 1938. The domestic market absorbed 22,744,566 tons, against 19,241,499 tons in 1950, an increase of 18·2 per cent. These figures do not include the Saar territory. The price of ore is still considered too low, despite two increases during the year. It is considered necessary that the price should be raised before the Schuman Plan comes into operation.

* * *

The Ministry of Public Works has published its road construction programme. The total amount to be spent is £150 million. The first stage will cover the expenditure of over £40,000 for urgent work. A five-year plan has been drawn up for the construction of fourteen highways, including new, wide roads connecting Paris-Lille, Paris-Strasburg, Paris-le Havre, Paris-Normandy coast, with branch roads, Paris-Brest, Paris-Bordeaux-Hendaye, Paris-Toulouse, Paris-Lyon by Nevers and Paris-Lyon by Auxerre, Bordeaux-Marseille with a branch road to Narbonne and Le Perthuis, and several other roads between provincial cities. A special road network to be known as the "Geneva System" will also be constructed. It will serve the proposed Mont Blanc tunnel and will include a Geneva-Lyon road and a Dijon-Geneva road. All the roads will have important branch roads. This plan does not include a special project for constructing a network of motorways. Monsieur Pinay, the present Prime Minister, drew up this plan when he was Minister of Public Works in the last Parliament. The first section will include a series of motorways round Paris, the cost being estimated at almost £4 million.

* * *

The French Resident General in Tunis recently inaugurated a new dam at Oued Mellegue. The construction of this dam will permit the irrigation of 40,000 hectares of land which could not be cultivated previously through lack of water. The reservoir has a capacity of 300 million cubic metres of water. The three principal works of the scheme are a primary and a secondary dam, and a hydro-electric power station. The primary dam is a multiple arch structure, the arches having a span of 50m, which is thought to be the largest span yet employed in this kind of construction. It is 65m high and 460m long. The arches have a thickness of 6·35m at the base and 2m at the crown, and are of mass concrete. The completed dam contains 200,000 cubic metres of concrete. The secondary dam has a single arch measuring 100m at the base and 240m at crown, and is 40m high. Its thickness is 8m at the base and 1m at the crown.

* * *

Work on the longest suspension bridge in France is now being completed at Terenez in Finistere. The new bridge is 346m long, with a central span of 272m. The supporting towers are 70m high. The road is 6m wide, with two pavements for pedestrians of 1m each.

* * *

French industry will equip steel mills at Paz de Rio in Columbia and also in Peru. The plant for Columbia will comprise furnaces with a daily capacity of 500 tons of coke. It also includes 22 tons Thomas steel converters and sheet rolling mills. Production, which will start in 1953, is initially planned for 100,000 tons per year. The French have already started shipping the plant to South America at a rate of 500 tons per month.

In Peru the French will construct an entire steel plant. It will be entirely different from that installed in Columbia. The pig will be produced in electric furnaces heated by hydro-electric power from a dam at Santa, with a power station of 50MW installed capacity, which can be increased to 150MW. The capacity of the plant will be 60,000 tons of pig iron per year and the installation must be completed by 1954.

Industrial and Labour Notes

British Overseas Trade

The final figures concerning this country's overseas trade during May were issued by the Board of Trade at the beginning of the week. They show that exports of United Kingdom goods were valued at £225,800,000, compared with a monthly average of £239,500,000 in the first quarter of this year. It should be noted that May contained one more working day than other normal months of this year. The Board says that exports to Australia were very much reduced last month by the restrictions on imports introduced recently by that country. They amounted to about £12,100,000, compared with £18,400,000 in April and an average of £34,400,000 in the first quarter.

Taking the two months, April and May, together, the value of United Kingdom exports averaged 7 per cent less than in the first quarter, exports of textiles showing the biggest reduction. In the same months, exports of engineering products fell only slightly—from £96,500,000 to £93,900,000—despite a reduction in shipments to Australia; exports of metals were in April and May slightly higher than in the first quarter. The small reduction in engineering exports in April and May, compared with the first quarter, affected all groups. The main exception, the Board of Trade says, was machinery, which averaged £37,400,000 in the two months, and was thus very much the same as in the first quarter despite a reduction in the same period in exports to Australia from £6,000,000 to £3,200,000 a month. Exports of vehicles declined from an average of £46,300,000 in the first quarter to £43,400,000 in April and May. In those two months shipments to Australia declined in value from an average of £9,300,000 to £3,700,000. But the severe reduction in exports of cars and chassis to Australia and New Zealand was partly offset by a considerable increase in shipments to Canada and, to a lesser extent, to the U.S.A. Exports of iron and steel and manufactures thereof in April and May averaged £17,400,000, or £1,500,000 more than the average for the first quarter, while the value of exports of non-ferrous metals, after falling in April, was higher in May than in the first quarter. Coal exports in May totalled 1,176,000 tons, valued at £5,400,000, compared with an average of £3,600,000 in the first quarter.

The value of imports during May was £320,400,000, compared with £325,500,000 in April and a monthly average in the first quarter of the year of £328,100,000. Re-exports in May declined in value to £9,800,000. The excess of imports (c.i.f.) over total exports (f.o.b.) in May was therefore £84,800,000, compared with £96,300,000 in April, and a first quarter average of £70,400,000.

Coal Exports

The Board of Trade's statement about exports and imports during May—which is referred to in the preceding note—says that in the first five months of this year the value of coal exports was £10,500,000 higher than in the corresponding months of 1951. In the same period of this year, coal imports totalled £2,700,000, against £7,800,000 in January–May, 1951.

Last week-end, the Minister of Fuel and Power, Mr. Geoffrey Lloyd, stated, in the course of a speech at Birmingham, that the Government had decided to make another increase of 1,000,000 tons in coal exports this year, bringing the total exports of all grades of coal up to 12,500,000 tons. In March, the Government announced that this year's coal exports would be 2,000,000 tons more than those of 1951, and a fortnight ago a further increase of 1,500,000 tons was decided upon. In his speech last week, the Minister said that the bulk of that extra coal had already been sold abroad. At present prices, he added, this year's coal exports should earn some £60,000,000 of foreign exchange, compared with just under £30,000,000 last year. Most of the coal, the Minister stated, was going to Europe.

Railway Wages

Last Monday evening it was announced that the Railway Executive had rejected the claim, put forward by the railway unions, for a 10 per cent increase in wages and extra pay for Saturday afternoon and evening work. The claim, it will be recalled, was formulated jointly by the National Union of Railwaymen, the Associated Society of Locomotive Engineers and Firemen, and the Transport Salaried Staffs' Association, and was submitted to the Railway Executive about a month ago. In rejecting the claim, no alternative offer appears to have been made. The last increase in railwaymen's pay was awarded last November, and represented an addition of about 8 per cent to existing wages and salaries.

Lead and Zinc

An increase in the price of lead was announced by the Ministry of Materials on Tuesday last, June 24th. On that day the United Kingdom price of good ordinary brand foreign lead was raised by £4 to £133 a ton delivered consumers' works. On the following day a further increase to £137 a ton was made. The price of zinc, on the other hand, has been reduced from £138 to £130 a ton, delivered consumers' works, as from June 20th. The premiums for higher grades remain unchanged.

In view of the improvement in zinc supplies, the Minister of Supply has made an Order—known as the Copper, Zinc, &c., Prices (No. 2) Order, 1952—freeing secondary zinc, zinc alloys, zinc scrap and gunmetal scrap from price control. The Order also adjusts the prices of secondary copper, brass, copper scrap, gilding metal scrap and cupro-nickel scrap to take account of recent changes in the selling prices of virgin zinc and copper as announced by the Ministry of Materials.

Iron and Steel Statistics

The British Iron and Steel Federation has just published Part I of its *Statistical Year Book for* 1951, which contains a wealth of information concerning all aspects of the United Kingdom's iron and steel industry. The tables included in the volume give details of last year's iron and steel production, finished steel deliveries, raw materials consumption, imports and exports, prices, stocks and employment. These tables have been grouped according to subject, beginning with iron ore and working through the various sections of the industry to the overseas trade statistics.

Two tables at the beginning of the volume are of particular interest in assessing progress and development in the British iron and steel industry. The first of these tables brings together the main statistics, for the last thirty years, of iron ore, coke, pig iron, scrap and steel. The second table summarises the statistics about the supply and disposal of steel since the beginning of this century. This table shows, for example, that the average annual crude steel production in this country from 1901 to 1905 was 5,140,000 ingot tons, the average annual imports amounting to 86,000 ingot tons. Of the total quantity of 6,000,000 tons thus available, 2,450,000 tons were exported and 3,550,000 tons taken up for home deliveries. Last year's steel supplies from home sources amounted to 16,610,000 tons and imports to 56,000 tons, making a total of 17,170,000 tons. Of that total 14,500,000 tons went in home deliveries, and 2,670,000 tons in exports.

Steel Scrap

The Minister of Supply, Mr. Duncan Sandys, has sent this week to the managing directors of 13,000 steel-consuming firms in this country a personal letter emphasising the great importance to this country of the steel scrap drive. The letter points out that the main cause of the prevailing scrap shortage is the result of the serious, but unavoidable, reduction in imports from Germany and elsewhere, and goes on to say that since there is no prospect of obtaining increased imports from any other sources abroad, efforts to collect more scrap at home must be intensified.

"If industry will make the effort to throw up more scrap quickly," the Minister's letter continues, "it will get it back over the next few months in the form of more steel." An appeal is therefore made to all firms to turn out at once any obsolete machinery or other unwanted ferrous material. Scrap merchants, or the District Scrap Drive Committees, will arrange for its collection. The letter adds that the prices payable for ferrous scrap to-day are higher than they have been for many years. It is worthy of note that over 300,000 tons of additional scrap were collected within steel works themselves last year as a result of the scrap drive, and that this year deliveries of scrap to steel works from outside sources have been increased by over 3000 tons a week.

The Price of Copper

The Ministry of Materials has now made a statement about the price of copper, following the negotiations with its main suppliers. It says that the quotation for copper in the *New York Engineering and Mining Journal* is the basis on which the Ministry pays for the copper bought under its contracts. But as recent developments forced that quotation up to a level which the Ministry considered to be unrepresentative of the market, negotiations were set on foot with the suppliers to fix an alternative basis of pricing. It has now been agreed that, to the end of this month, at any rate, copper sold to the Ministry on the basis of the June price shall be valued at 33 cents a pound, instead of the higher quotation given in the *New York Engineering and Mining Journal*. This arrangement has enabled the Ministry of Materials to maintain the price at £281 a ton, announced on June 14th.

There are hopes that the copper market will settle down shortly and that steady trading in copper will be resumed throughout the world. Nevertheless, the statement explains, as the negotiations with the Ministry's suppliers were not opened until the course of the *Journal* copper quotation was known, there was a period of approximately a fortnight during which the Ministry sold copper at £231 a ton while its buying prices were much higher. Losses thus incurred will have to be recovered during the current financial year, and the Ministry's present selling price of £281 includes an item of £5 a ton on that account. Other charges which the Ministry has to cover, such as freight, refining, interest on capital employed and cost of delivery to consumers' works have increased, and it has therefore had to raise its margin for that purpose by an additional £1.

Sweden's Industrial Production

A report published recently by the Swedish Economic Research Institute states that the volume of industrial production in Sweden was 47 per cent greater in 1950 than it was in 1939. According to preliminary calculations made by the Institute there was a further increase of about 4 per cent during 1951. The report says also that between 1939 and 1950 production per man-hour among manual workers increased by 23 per cent. It is pointed out in the report, however, that there are indications that "this exceptional period is approaching an end and that expansion is levelling off." Technically, the report says, a further rise in productivity would seem possible, as investment in manufacturing processes—particularly in new machinery—was high last year and will probably remain high throughout this year.

Notes and Memoranda

Rail and Road

KINGSWAY TRAM SUBWAY.—In reply to a question in Parliament on June 23rd, the Parliamentary Secretary to the Ministry of Transport stated that it was hoped that the report of the technical committee on the Kingsway (London) tram subway would be ready in a few weeks. The traffic schemes and the engineering problems involved were complex and had required a great deal of investigation. The Parliamentary Secretary added that about thirty different suggestions as to the future use of the subway had been put before the committee.

THE HIGHWAY DEVELOPMENT PROGRAMME.—A question put to the Minister of Transport on Monday last asked what proportion of the ten-year highway development programme announced in May, 1946, had now been completed, and how much of the 800 miles of proposed new motorways had either been built or was now under construction. The Parliamentary Secretary, who replied, said that progress with the programme had been severely restricted by economic conditions. A few substantial works of major improvement had been completed or put in hand and plans had been prepared for others. No motorways, he added, were under construction, although some preparatory planning was being carried out.

Air and Water

MINESWEEPER LAUNCH.—Her Majesty's Inshore Minesweeper Number 5, which has a length of 106ft 5in and a beam of 20ft 6in, was launched from the shipyard of Vosper, Ltd., on June 24th.

SUEZ CANAL TRAFFIC.—Statistics of the Suez Canal Company for 1951 show that 76,753,000 tons of cargo were transported in 11,694 transit passages of ships of 80,356,338 net tons, which includes 23,577,000 tons in ballast and the remainder loaded. The volume of cargo represented a 5·7 per cent increase over the previous year, and products other than oil accounted for 31,949,000 tons or 28 per cent over the 1950 total. Of the total, Britain participated to the extent of 37,041,000 gross tons and 4091 passages; the Persian oil crisis was the main cause of the reduction of the tonnage in ballast.

LLOYD'S WRECK RETURNS.—The statement of merchant ships totally lost and broken up for the quarter ended December 31, 1951, has been issued by Lloyd's Register of Shipping. During the period steamships and motorships lost, consequent upon casualty, totalled fort-eight of 61,949 tons gross, of which five ships of 2819 tons belonged to Great Britain and Northern Ireland and six ships of 1620 tons to the Commonwealth countries. Of the ships lost not consequent upon casualty, seventeen ships of 15,685 tons gross belonged to Great Britain and Northern Ireland and two ships of 1908 tons to the Commonwealth countries. The world total of ships under this category amounted to sixty-three vessels of 54,074 tons gross.

INTERNATIONAL WATER SUPPLY MEETINGS.—The second congress of the International Water Supply Association was held in Paris recently, from June 9th to 13th, when an extensive programme of technical sessions and visits took place. The various reports discussed by the congress were as follows: determination of standards for expressing physical, chemical and bacteriological results of drinking water examination; artificial replenishment of underground water; treatment of water before filtration; water softening; a survey of supply and delivery systems, flow control, leak detection, &c.; protection of networks against corrosion; the presence of "algae" in waters used for consumption; experimental verification of coefficients in pipe-line formulæ; and the calculation of mesh networks. In addition three "communications" were submitted to the congress entitled: "Technical Nomenclature," "Legislative Measures for Developing Supplies in Rural Districts" and "Rapid Filters."

Miscellanea

THE LATE DR. J. A. THOMSON.—We have learned with regret of the death, on June 20th, of Dr. J. A. Thomson, chairman and managing director of Brown Brothers, Ltd., Great Eastern Street, London, E.C.2.

GAS-BLAST CIRCUIT BREAKERS.—The British Electrical and Allied Industries Research Association has issued a report (Ref. G/T255) on the study of air flow in circuit breakers. It discusses the principles underlying the effect of the presence of an arc on the pressure and flow in a nozzle. Further experimental results on mean mass flow through, and pressure developed in, a nozzle under varying conditions of diameter and current are given and certain conclusions are drawn therefrom. These results apply only in the case where the arcing chamber pressure is 80 lb per square inch gauge, but it is planned to extend the investigation to cover the effect of higher and lower pressures. The price of the report is 10s.

PRICES OF LEAD AND COPPER.—The Ministry of Materials announces that the price of imported good soft lead pig is now increased from £133 to £137 per ton delivered consumers' works. Its buying price for rough copper in slabs of from 2 cwt to 3 cwt has been raised from £180 to £230 per ton.

ASSOCIATION OF SUPERVISING ELECTRICAL ENGINEERS.—Mr. L. L. Emmett, electrical engineer of the United Leeds Hospitals, has been elected national chairman of the Association of Supervising Electrical Engineers. Mr. J. Flood has been elected vice-chairman, and Mr. E. J. Sutton, honorary treasurer.

NEW ATOMIC PLANTS IN THE UNITED STATES.—According to Reuter, the United States is to build a new atomic plant costing nearly 2000 million dollars. The site of the new plant has not yet been decided upon, but will probably be in the Ohio Valley. The Atomic Energy Commission also proposes to spend a further 1500 million dollars on the expansion of two existing plants and the completion of two others now under construction.

CLASSIFICATION OF COPPER AND COPPER ALLOYS.—The Copper Development Association has issued a new edition of its publication *Classification of Copper and Copper Alloys*. The issue of new British Standards since the publication of the last edition of this brochure in 1948 has necessitated a revision of the tables to bring them up to date, and the opportunity was taken to revise the whole book and to include information on some additional copper base alloys, which are now of commercial importance.

INDUSTRIAL FILM COURSE.—The Industrial Welfare Society has arranged a one-day display of films dealing with vocational guidance, works information, training, safety, selection, induction instruction, the supervisor and human relations, and kindred industrial topics. The films will be shown—at two sessions beginning at 9.45 a.m. and 2.15 p.m.—next Wednesday, July 2nd, at Robert Hyde House, 48, Bryanston Square, London, W.1. The films will be introduced by people directly concerned in the making of them, thus enabling discussion to follow where suitable. The fee for members of the Society wishing to attend the display is one guinea.

RUGELEY POWER STATION.—The Minister of Fuel and Power was asked in Parliament last week whether the new power station to be erected adjacent to the Lea Hall pit, Rugeley, would be in operation in time to receive direct supplies of fuel from the pit in question. In reply, the Minister said that the colliery and the power station were being developed together. The British Electricity Authority expected to commission the first generator in the Rugeley station in 1958, by which time the colliery should be starting to produce coal. It was hoped to complete the station with a capacity of 540MW by 1963, when the colliery should also have reached full production.

TAR SURFACE DRESSINGS.—The Department of Scientific and Industrial Research has published, through H.M. Stationery Office, the second edition of *Road Note No.* 1, which was originally issued in 1947. This report modifies some of the earlier recommendations in the light of further research and experience on surface dressing with tar. The most important factors which determine the life of a surface dressing are the amount of tar used and the uniformity of its application. The recommendations enable the engineer to specify the rate of spread for any particular job, according to the size and shape of chippings and the nature of the road surface and the traffic. Somewhat thicker applications of binder are now recommended, particularly for lightly trafficked roads. Another new recommendation is that for surface dressing porous surfaces the size of the chippings should not exceed ¼in. The note stresses the need for responsible supervision and control over the materials and their application, and the advantage of keeping careful records of the work.

ELECTRONICS COURSE AT HARWELL.—Applications are invited by the Atomic Energy Research Establishment, Harwell, from physicists and electronic engineers holding a degree, or equivalent qualification, who wish to attend a specialised course on the design, use and maintenance of electronic instruments used in nuclear physics, radiochemistry, and in work with radio-isotopes. The course, to be held at the Isotope School, Harwell, will be from Monday, July 14th, to Friday, July 18th. The course will include lectures and practical work concerned with counters, d.c. and pulse amplifiers, coincidence units, scalers and rate meters. The Isotope School is outside security rules and the subjects will be entirely unclassified.

SHOCK-ABSORBING WAGONS.—For the conveyance of fragile traffics such as glass, china and earthenware, British Railways intends to increase its fleet of 3500 shock-absorbing freight vehicles to over 5100 by the end of the year. The bodies of these vehicles, which are known as "Shocks" (open wagons) and "Shocvans" (covered vans), are permitted movement on the chassis. Instead of the two components forming a rigid unit, the body can slide backwards and forwards on the chassis, the movement being limited by rubber springs. The result is that the effects of shunting are "cushioned" and fragile consignments travel with the minimum risk of damage. The vehicles will be built in British Railways workshops at Faverdale (Co. Durham), Derby, and Ashford (Kent).

P.E.R.A. REPORT FOR 1951.—At the annual general meeting of the Production Engineering Research Association of Great Britain on June 24th, the following new members were elected to the council:—Mr. B. H. Dyson, Mr. E. W. Hancock, the Hon. John Grimston, M.P., and Mr. J. W. C. Milligan. The seventh annual report presented by the council gave particulars of new equipment purchased by or loaned to the Association for its work at Melton Mowbray. The section of the report on research gives notes on some investigations in progress during the year covering a wide field of machining, materials, tools, machines, &c. In connection with new work it is stated that for five new investigations programmes were completed and the design and manufacture of suitable equipment commenced. These new investigations are concerned with thread rolling, impact extrusion, machine tool slideways, grinding machine performance, and a mechanical dry cleaning unit for ferrous wire. Four private investigations were undertaken at the request of member firms during the year and some 650 technical inquiries of widely different types were dealt with. The income of the Association amounted to £82,030, an income of £6867 over the previous year. Membership totalled 320 firms, representing an annual increase from industry of £45,000. The council, in view of the expansion which will be necessary in the next few years, has made special allocations of income for use in the membership drive.

Personal and Business

RUBERY, OWEN AND CO., Ltd., Darlaston, Staffs, announces the appointment of Mr. Peter Spear, B.Eng., as director of research.

DR. D. V. ATTERTON has been appointed research and development manager of Foundry Services, Ltd., Long Acre, Nechells, Birmingham.

MR. A. KENNETH CLYDE, A.M.I.E.E., has been appointed assistant chief engineer of Tiltman Langley Laboratories, Ltd., Redhill, Surrey.

THE RADIO COMMUNICATION AND ELECTRONIC ENGINEERING ASSOCIATION has moved to 11, Green Street, London, W.1 (telephone, Mayfair 7874).

J. M. J. MARIS, Ltd., 35, New Broad Street, London, E.C.2, has taken up the agency in this country for Harburger Eisen und Bronzewerke A.G., Hamburg.

THORIUM, Ltd., states that the postal address of its head office has been changed from Princes Street to 10, Storey's Gate, London, S.W.1. The location of the office is unchanged.

CANADIAN PACIFIC STEAMSHIPS, Ltd., announces that Captain C. E. Duggan, R.D., R.N.R., the commander of the "Empress of Scotland," has been appointed R.N.R. Aide-de-Camp to Her Majesty the Queen.

MR. C. H. CHAPLAIN, publicity manager of the British Thomson-Houston Company, Ltd., has been elected chairman of the BEAMA publicity committee. Mr. V. J. Faulkner, publicity manager of Crompton-Parkinson, Ltd., has been elected vice-chairman.

HOLMAN BROS., Ltd., Camborne, Cornwall, is opening a branch in Nairobi on July 1st. The postal address will be P.O. Box 2044, Nairobi (telephone, Nairobi 84–25; telegrams, "Airdrill, Nairobi"). The branch, which is to serve Kenya, Tanganyika and Uganda, will be managed by Mr. J. B. Passmore

British Patent Specifications

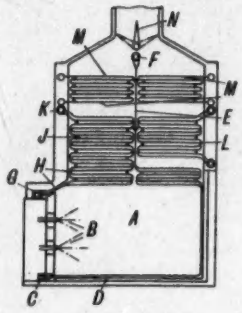
When an invention is communicated from abroad the name and address of the communicator are printed in italics. When an abridgment is not illustrated the specification is without drawings. The date first given is the date of application: the second date, at the end of the abridgment, is the date of publication of the complete specification.

Copies of specifications may be obtained at the Patent Office Sales Branch, 15, Southampton Buildings, Chancery Lane, W.C.2, 2s.8d. each.

STEAM GENERATORS

670,944. July 14, 1950.—Forced Recirculation Tubular Steam Generators, La Mont International Association, Ltd., 8, Waterloo Place, London, S.W.1 (*Inventors: Karl Hans Reppel and Pierre Frederic Pourchot*).

This invention relates to water-tube boilers of the forced recirculation type and its main object is to provide for a wide range of superheat control. The boiler comprises a combustion chamber *A* which is fired by burners *B* in the port wall or one of the side walls. From a header *C*, shown at the lower left-hand corner, there proceed evaporating tubes *D* which cover the floor of the combustion chamber and one side wall. After forming half



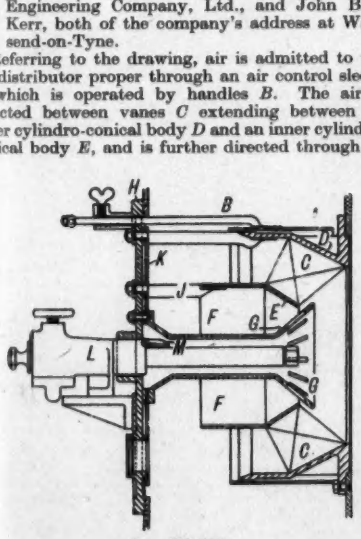
No. 670,944

of the roof of the combustion chamber, these tubes return and are bent again, running to the middle of the combustion chamber to form the small evaporator tube bank, from where they are led vertically upwards to form a partition wall *E*. At their upper end the tubes are connected to a collector header *F*, which is connected to the steam and water drum. From a distributor header *G*, situated vertically above the header *C*, there proceed the other evaporating tubes *H*, which form the second half of the combustion chamber roof and, in their continuation, a large evaporator bank *J*. They end in a collector header *K*, which is connected to the steam and water drum. *L* is the superheater, *M* the economisers, and *N* the damper.—*April* 30, 1952.

FURNACES AND BURNERS

672,583. September 30, 1950.—Air Directors for Fuel Burners, Wallsend Slipway and Engineering Company, Ltd., and John Bain Kerr, both of the company's address at Wallsend-on-Tyne.

Referring to the drawing, air is admitted to the air distributor proper through an air control sleeve *A* which is operated by handles *B*. The air is directed between vanes *C* extending between an outer cylindro-conical body *D* and an inner cylindro-conical body *E*, and is further directed through an



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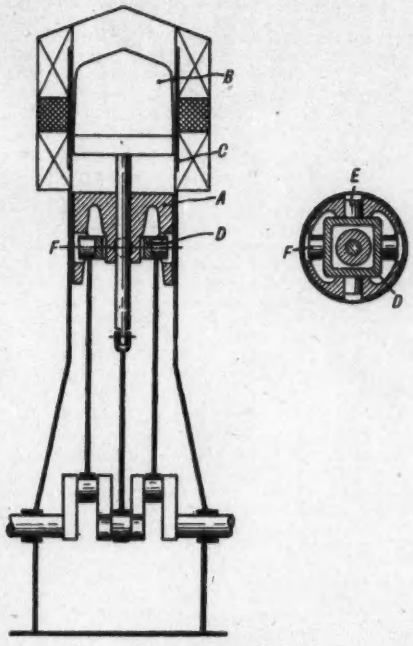
annular space *F* which is formed between the body *E* and the air diffuser *G*. The truncated conical end of the inner body *E* is of such diameter as to ensure a given velocity of air passing through the ports in the diffuser *G*. The bodies are supported from the front plate *H* by tie rods *J*. A screen plate *K* attached to the front plate is spaced from it to allow for an air supply to the interior of the air diffuser *G*, whereby air is free to cool the burner body and prevent overheating and carbonising of the fuel in the burner body. The burner carrier *L* is axially adjustable, and is fitted with a hinged flap *M* which drops to prevent any back flash.—*May* 21, 1952.

HOT AIR ENGINES

672,322. January 13, 1950.—Reciprocating Engines with Two Co-axial Pistons, N. V. Philips' Gloeilampenfabriken of Emmasingel 29, Eindhoven, Holland.

The object of the invention is to provide a reciprocating engine comprising two pistons moving co-axially, in which the possibility of the second piston taking up an inclined position is substantially avoided. The drawings show a sectional view of an external combustion, or air engine, in which the pistons *A* and *B* reciprocate in a cylinder *C*. The rod of the upper piston passes through the centre of the lower piston. This lower piston has a four-bearing ring *D*, which is rotatably secured to the



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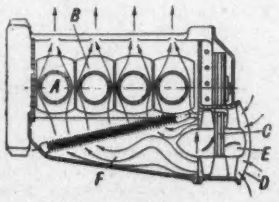
piston by the journals *E*, and to the two outer connecting-rods, by journals *F*. The connecting-rods are secured to the two outer cranks. The piston *B*, which acts as the displacer piston, is connected by its rod and a connecting-rod to the centre crank of the crankshaft, which is set at an angle of 90 deg. to the two outer cranks. The outer connecting-rods instead of being rotatably secured to the ring *D* by means of journals *F* may be resiliently coupled and the journals *E* may be replaced by a resilient connection to the piston.—*May* 21, 1952.

INTERNAL COMBUSTION ENGINES

673,483. May 1, 1950.—Oil-Cooler Arrangement in Air-Cooled Internal Combustion Engines, Scheizerische Lokomotive-und Maschinenfabrik, Winterthur, Switzerland.

As shown in the drawing, the engine comprises four separate cylinders *A* disposed in line and provided with cooling fins *B* at right angles to the



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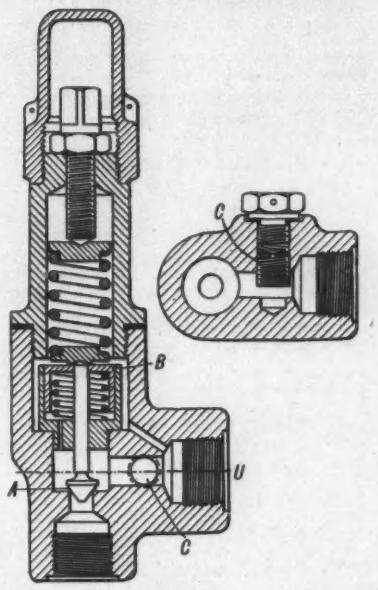
cylinder axes. The cooling-air fan *C* is at one end of the row of cylinders on the level of the cylinder midpoints and is driven through "V"-belts. An air intake nozzle *D* involving a system of guide vanes *E* is situated upstream of the fan. Downstream of the fan is an air duct *F*, through which the cooling air flows to the cylinders.

An oil cooler arranged inside the air duct at an acute angle to the line of cylinders comprises finned horizontal pipes. The oil cooler is washed by the entire stream of cooling air, the latter being guided or deflected through the fins from a longitudinal direction into a transverse direction relative to the cylinder and then passing through the line of cylinders. In this arrangement the oil cooler fins act similarly to the deflecting vanes of a wind canal. They perform a "combing" action on the air stream and prevent eddies. The mass flow therefore, is uniformly distributed on to the individual cylinders. A modified design is also shown in the specification.—*June* 4, 1952.

VALVES

672,340. January 31, 1950.—Safety and By-pass Valves, Aktiebolaget Imo-Industri, Lindhagensgatan 132, Stockholm, Sweden (*Inventor: Carl Oscar Josef Montelius*).

In the safety and by-pass valve shown in the drawing, the valve *A* is spring-loaded and a damping piston *B* is subjected to the action of a second weaker spring. The second spring and piston counteract and damp the closing motion of the valve without delaying its opening motion, and the



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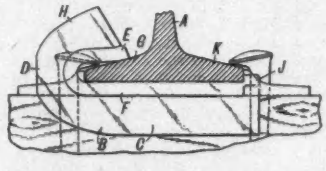
opposite sides of the damping piston are connected to the passage of flow at different points so that the piston is influenced by the difference in pressure which arises by the flow of the medium. As shown, an adjustable throttle device *C* in the passage of flow is provided to permit the difference of pressure on the damping piston to be controlled.—*May* 21, 1952.

RAILWAY ENGINEERING

673,461. December 20, 1950.—Rail Anchors, The P. and M. Co. (England), Ltd., 1a, Grosvenor Gardens, London, S.W.1.

Referring to the drawing, *A* indicates a rail with an anchor *B* mounted on it, comprising a body portion *C* and a hook portion *D*. In the arrangement shown the hook portion provides the anchor with upper and lower jaws *E* and *F* positioned to bear against the top and bottom surfaces of the base flange *G* of the rail. The metal bar from which the anchor is made is preferably "T"-shaped in cross section so as to give maximum



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strength and stiffness in proportion to the amount of metal used, the vertical rib *H* being preferably centred with respect to the horizontal arms of the bar. For the application of the anchor to the rail, it is first placed loosely on the rail and force is then applied to the anchor, preferably by blows on the end *D* of the hook, causing the upper jaw *E* to travel upwards and inwards on the sloping top face of the flange *G* of the rail. At the end of the movement of the anchor toward the right into position on the rail, a shoulder *J* on the end of the body *C* is caused to have snap engagement with the side face of the adjacent flange *K* of the rail so as normally to prevent return movement of the anchor toward the left.—*June* 4, 1952.

Forthcoming Engagements

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of their insertion, the necessary information should reach this office on, or before, the morning of the Monday of the week preceding the meetings. In all cases the TIME and PLACE at which the meeting is to be held should be clearly stated.

Institute of Industrial Administration

Thurs., July 10th.—LONDON CENTRE GRADUATE SECTION: Management House, 8, Hill Street, W.1, "The Presentation of Data as an Aid to Efficiency," B. P. Dudding, 7 p.m.

Institute of Physics

To-day, and Sat., June 27th and 28th.—Royal Technical College, Glasgow, Fourth Industrial Physics Conference and Exhibition: Physics in the Transport, Shipbuilding and Engineering Industries.

Institution of Civil Engineers

Fri., July 11th.—Summer meeting in Coventry and Stratford-upon-Avon. Coaches leave the James Watt Memorial Institute, Great Charles Street, Birmingham, 1 p.m.

Institution of Electrical Engineers

To-day, and Sat., June 27th and 28th.—Summer Meeting in Ireland.

Institution of Mining Engineers

Wed. to Fri., July 2nd to 4th.—Summer Meeting at Keele, near Stoke-on-Trent.

Institution of Sanitary Engineers

Fri., July 4th.—Caxton Hall, Westminster, London, S.W.1, annual general meeting, 5.15 p.m., "Crawley New Town Engineering Works," A. J. W. McIntosh, 6 p.m.

Sat., July 5th.—Whole-day visit to Crawley New Town residential neighbourhoods and factory area, sewage treatment works, Weir Wood impounding reservoir with dam, under construction, and small prestressed concrete reservoir.

Launches and Trial Trips

IRISH HEATHER, coaster; built by the Goole Shipbuilding and Repairing Company, Ltd., for Irish Shipping, Ltd.; length 204ft, breadth 35ft, depth 14ft 6in, deadweight 1360 tons; British Polar diesel engine, 960 b.h.p. at 250 r.p.m. Launch, June 10th.

SINGULARITY, coaster; built by the Goole Shipbuilding and Repairing Company, Ltd., for F. T. Everard and Sons, Ltd.; length 225ft, breadth 57ft 10in, depth 16ft, deadweight 1815 tons, speed 10¾ knots; one Newbury diesel engine, four cylinders 407mm dia. by 600mm stroke, 800 b.h.p. at 240 r.p.m. Trial, June 12th.

BRITISH SKILL, oil tanker; built by Harland and Wolff, Ltd., Belfast, for the British Tanker Company, Ltd.; length between perpendiculars 610ft, breadth moulded 81ft, depth moulded 44ft 6in, deadweight 28,500 tons; thirty cargo oil tanks, one cargo pump room; a single set of compound double-reduction geared turbines, 12,500 s.h.p. at 112 r.p.m. of propeller, two oil-fired Babcock and Wilcox integral furnace boilers supply steam at 450 lb per square inch and 750 deg. Fah.; two B.T.H. 600kW turbo alternators, two B.T.H. motor-driven generators, one Ruston and Hornsby 150kW diesel-alternator. Trial, June 12th.

BASRAH-FAO PIPE-LINE.—A 24in pipe-line is to be laid parallel to the existing 12in pipe-line and so increase the output of the Zubair oilfields fourfold. The 80-mile long Basrah-Fao pipe-line will consist of 17,000 tons of 24in pipe, the contract for which has been placed with the South Durham Steel and Iron Company, Ltd., by the Basrah Petroleum Company. Production of the pipe is by a new method by which plates 26ft long are rolled and fixed by an inside welded seam. A reinforced bead weld is applied on the outside and the welds are X-ray tested. Other tests include the "bouncing" of a 400ft length of pipe from a height of 8ft and dropping it from 15ft. The new pipe-line in conjunction with the 30in Kirkuk to Banias line and existing pipelines there, will make available 30,000,000 tons of oil per annum from Iraq at the Mediterranean and Persian Gulf ports.

Technical Reports

Stainless Steel Magnetic Recording Wire (Ref. N/T61). By Professor W. Sucksmith, F.R.S. The British Electrical and Allied Industries Research Association. Price 6s., postage 3d.—This is a report of an investigation into the magnetic properties of stainless steel recording wire in the light of the theories of Stoner and Wohlfarth, on the one hand, and Néel on the other, on the shape anisotropy mechanism of hysteresis in heterogeneous magnetic alloys. The variation of coercive force and J_{REM}/J_{SAT} with time of heat-treatment at 450 deg., 500 deg. and 550 deg. Cent. were required.

The Design and Development of Three New Types of Gust Anemometer (Ref. C/T106). By H. H. Rosenbrock. The British Electrical and Allied Industries Research Association. Price 24s., postage 4d.—Three new types of gust anemometer have been developed by the E.R.A., to measure, respectively, the horizontal component of the wind velocity; the horizontal component at right angles to the mean wind direction, and the vertical component of the wind velocity. This report describes the development of the anemometers and gives sufficient information to allow similar instruments to be built.

Temperature Gradients in Transformer Windings and Rates of Oil Flow in Transformer Tanks: A Critical Review of Published Information (Ref. Q/T117). By B. L. Coleman, B.Sc. The British Electrical and Allied Industries Research Association. Price 6s., postage 3d.—A knowledge of the physical mechanism by which the heat generated inside a transformer tank is dissipated is necessary if the designer is to keep hot spot temperatures as low as possible. This report reviews the attempts which have been made to deal with this problem theoretically and empirically, for transformers of the natural oil-cooled type having concentric windings.

The Operation of Naturally Cooled Outdoor Transformers as Affected by Weather and Surroundings. Preliminary review (Ref. Q/T118). By M. R. Dickson, B.Sc. (Eng.). The British Electrical and Allied Industries Research Association. Price 18s., postage 4d.—The heating effects of the sun or the cooling effects of wind, rain, &c., are of growing importance as loads approaching the permissible maximum are taken from transformers. The present review has been made as a basis for any further investigation of this subject. Use is made of calculations for three specimen transformers to obtain rough numerical information as to these effects.

Field Dependence of the Dielectric Constant (Ref. L/T258). By J. J. O'Dwyer. The British Electrical and Allied Industries Research Association. Price 6s., postage 3d.—A very general calculation can be made giving the dielectric constant of a material in terms of the spontaneous fluctuations of the electric moment of the material which would occur in a field free region. It is the purpose of the present calculation to extend the work done by Fröhlich one step further, thus including the first term in the field dependence of the dielectric constant. To preserve continuity of argument it has been found necessary to reproduce a great deal of Fröhlich's work. The work was carried out at Liverpool University.

The A.C. Argonarc Process for Welding Aluminium: An Oscillographic Analysis of Effects of Welding Transformer Open Circuit Voltage on Arc Re-ignition (Ref. Z/T82). By L. H. Orton, Ph.D., F.Inst.P., and J. C. Needham, B.Sc. (Eng.). The British Electrical and Allied Industries Research Association. Price 5s., postage 4d.—This report is the second of a series on the oscillographic analysis of electrical phenomena in the a.c. argonarc process for welding aluminium, the first being Ref. Z/T80. The arc has here been examined using oscillographic techniques with time resolutions down to microseconds, and the very considerable differences in both the arcing and re-ignition characteristics between the straight and reverse polarity half cycles have been analysed. The arc re-ignition process for the reverse polarity half cycle is shown to be very complex, and, in general, there is a series of "ignition oscillations," each cycle of which lasts some 10 microseconds and is repeated some ten to fifty times, before the arc is finally established in the half cycle. Voltages have been established for maintaining the arc both with and without h.f. spark injection, with and without a large series capacitor, on commercially pure aluminium and an aluminium–5 per cent magnesium alloy. It is shown that the spark injector permits a drop of about 60V in open circuit voltage from that required for a self-maintaining arc, and the addition of a series capacitor, about 15V reduction. The marked effects of surface condition and material of the work plate on the required voltage have also been demonstrated. The data provide a probable explanation of the apparent discrepancy in the open circuit voltages extant in literature.

Under optimum conditions the argonarc was successfully maintained on an Al–5 per cent Mg plate at an open circuit voltage as low as 45V r.m.s.

Contracts

HEAD, WRIGHTSON ALUMINIUM, Ltd., announces that it has been appointed by the Ministry of Civil Aviation as sub-contractors to W. and C. French, Ltd., for the supply and erection of four main hangar doors for London Airport. Constructed entirely of aluminium alloy, the electrically operated folding leaf doors will cover an opening measuring 300ft by 46ft.

Catalogues

PETBOW, Ltd., Richborough Works, Sandwich, Kent.—Illustrated leaflet describing automatic a.c. power plants.

JOHN GIBSON AND SON, Ltd., Jameson Place, Leith, Edinburgh, 6.—Illustrated folder describing Gibson mobile tower ladders.

HOUCHIN, Ltd., Garford Works, Garford Street, London, E.14.—Booklets dealing with alternators and diesel generating sets.

CONSOLIDATED PNEUMATIC TOOL COMPANY, Ltd., 232, Dawes Road, London, S.W.6.—Catalogue of stationary air compressors.

PETROLEUM FILMS BUREAU, 29, New Bond Street, London, W.1.—1952 List of 35mm and 16mm documentary and instructional films.

BRITISH INSULATED CALLENDER'S CABLES, Ltd., 21, Bloomsbury Street, London, W.C.1.—Illustrated booklet giving details of P.B. Poles.

GEO. W. KING, Ltd., Hitchin, Hertfordshire.—Leaflets describing the light-weight Bantam II hard chain-block and the King sack hoist.

MULLARD, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.—Publication dealing with "Photocells for Industrial Applications."

SMALL ELECTRIC MOTORS, Ltd., Beckenham, Kent.—Leaflet describing the S.E.M. centrifugal switch dust cover for single-phase a.c. motors.

GENERAL ELECTRIC COMPANY, Ltd., Magnet House, Kingsway, London, W.C.2.—Illustrated folder of fittings and cold cathode fluorescent tubes.

STURTEVANT ENGINEERING COMPANY, Ltd., Southern House, Cannon Street, London, E.C.4.—Publication No. 8801, entitled "Vibrating Screens."

RAGOSINE OIL COMPANY, Ltd., Minerva Works, Woodlesford, near Leeds.—Booklet entitled "Industrial Lubricants and Engineering Specialities."

MECHANISED HANDLING PLANT AND MACHINERY, Ltd., Maxwell House, Arundel Street, Strand, London, W.C.2.—General catalogue of mechanical handling equipment.

ELTRON (LONDON), Ltd., Accrington Works, Strathmore Road, Croydon, Surrey.—Leaflet giving overall dimensions and particulars of standard air heating ducts.

AUTOMATIC TELEPHONE AND ELECTRIC COMPANY, Ltd., Strowger Works, Liverpool, 7.—Publication No. 2308/2 of mosaic diagrams for centralised supervisory stations with or without remote control.

LONDON FAN AND MOTOR COMPANY, Ltd., 91a, Burghley Road, Tufnell Park, London, N.W.5.—Catalogue dealing with (1) heavy duty reversible breeze propeller fans; (2) medium duty Trojan fans (for refrigeration duty); (3) light duty Cadet fans for free air.

BLAW KNOX, Ltd., 90/94, Brompton Road, London, S.W.3.—Publications BK-153, giving particulars of the BK-12 motor grader and BK-157 and BK-158, giving details of hydraulic bulldozer for the "Trackmaster 30" crawler tractor, and the hydraulic angledozer for the "Trackmaster 50" crawler tractor.

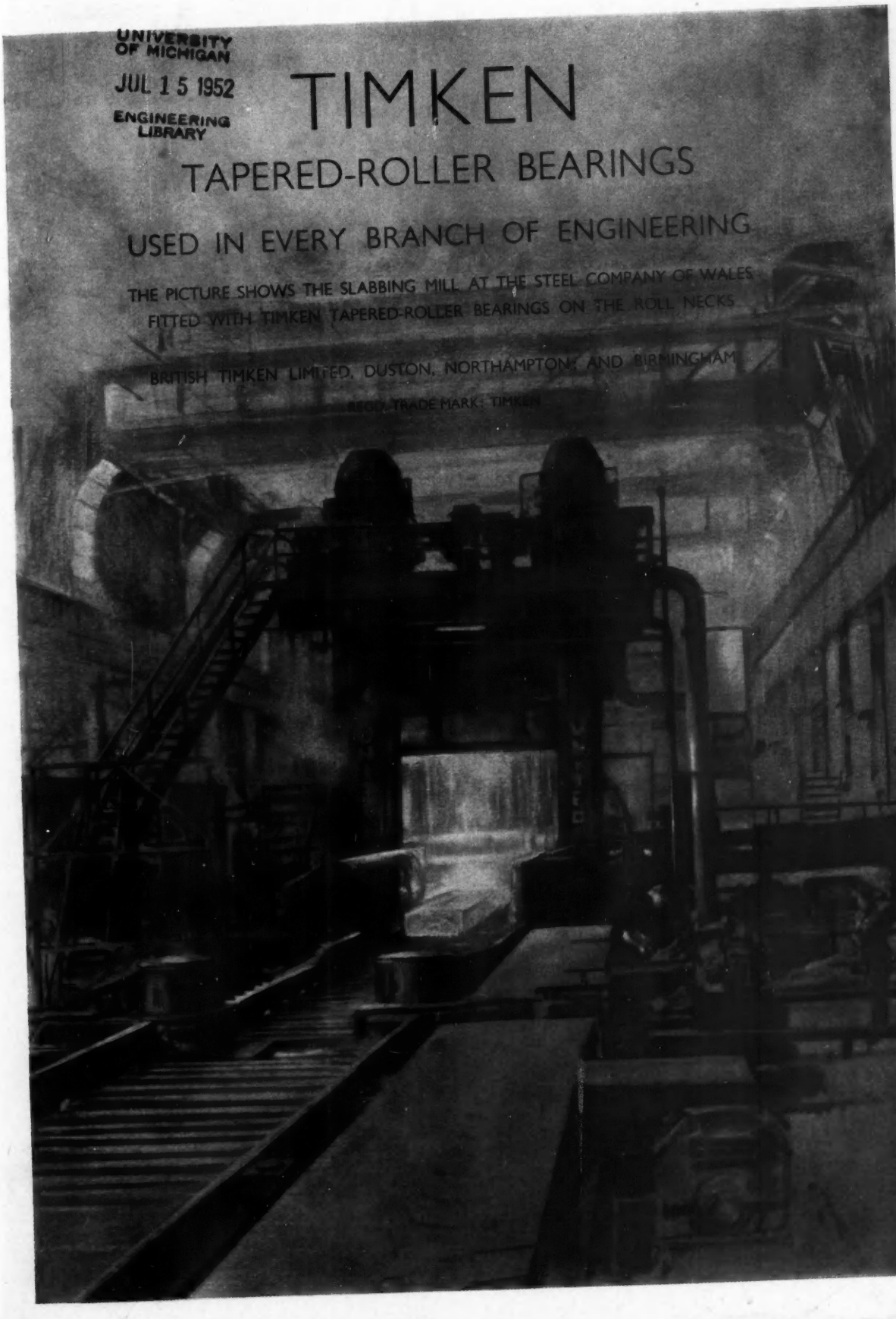
ENGLISH ELECTRIC COMPANY, Ltd., Queens House, Kingsway, London, W.C.2.—Publications entitled "Liverpool Street-Shenfield Service, British Railways, Eastern Region," "Polish State Railways, Warsaw Suburban Lines," "Air-Blast Circuit-Breaker 66kV for Blockhouse or Cell Mounting—Frame 'C,'" and data sheet for the RK range of diesel engines.

END OF VOL. CXCIII

The Engineer

JUNE 27, 1952 28, ESSEX ST., STRAND, LONDON, W.C.2. TWO SHILLINGS

UNIVERSITY OF MICHIGAN
JUL 15 1952
ENGINEERING LIBRARY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THE PICTURE SHOWS THE SLABBING MILL AT THE STEEL COMPANY OF WALES FITTED WITH TIMKEN TAPERED-ROLLER BEARINGS ON THE ROLL NECKS
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The Brightside range of rolls for hot and cold rolling is keeping pace with the exacting requirements of the steel and non-ferrous industries at home and abroad

The illustration shows a group of Alloy Chill Hot Rod Finishing Rolls with roller-bearing mounted chocks.

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PUBLIC NOTICES

HER MAJESTY'S COLONIAL SERVICE

HUMMING BIRD HIGHWAY (27322/242), BRITISH HONDURAS

RESIDENT ENGINEER

Applications are invited for the following post :—
RESIDENT ENGINEER, Humming Bird Highway (27322/242), British Honduras.

A Resident Engineer is required for the construction of the new main road from Roaring Creek to Middlesex (part already completed), including design and construction of bridges and culverts. The Resident Engineer will be in charge of construction under direction of the D.P.W.

Candidates should be Corporate Members of the Institution of Civil Engineers or equivalent, with wide experience in road and bridge design and construction, and handling of heavy road construction equipment. Appointment on agreement for 18 months with possible extension for a further six months. A salary of up to £2000 per annum (paid locally in British Honduras dollars : 4 dollars equals £1) will be given to a suitably qualified candidate having exactly the required experience.

Other terms as follows :—Cost-of-living allowance of £36 per annum at present paid, but liable to variation or withdrawal at any time. If Government quarters in Belize are allocated to officer, rental of 10 per cent of salary is payable. When in camp bush accommodation and certain basics furniture is provided. Transport and subsistence allowances paid when travelling on duty. Free passages to British Honduras provided for officer, wife and children, not exceeding four persons in all, and back to U.K. on satisfactory completion of agreement. Free medical attention provided for officer only. Income tax payable at rates much lower than in U.K. Generous leave on full salary granted on satisfactory completion of agreement.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number (27322/242). E9379

AUSTRALIA

THE SNOWY MOUNTAINS HYDRO-ELECTRIC AUTHORITY

ENGINEERS AND ARCHITECT

The Snowy Mountains Hydro-Electric Authority invites applications for appointment to the following positions. In all cases the commencing salary in any particular grade will be determined after interview, in accordance with qualifications and experience. The salaries quoted are in Australian currency and the particular qualifications required are shown hereunder.

CIVIL ENGINEERS

1. EXECUTIVE ENGINEERS, Grade III, £2006/£2316 p.a.

(a) Dam Design. A comprehensive knowledge of modern engineering techniques and criteria pertaining to the design of high dams and ability to plan integrated engineering programmes and field investigations, carry out comparative analyses of alternative types and direct preparation of designs, estimates and specifications.

(b) Contracts. Extensive experience in the driving and operation of large underground tunnels and in the supervision of large contracts for the construction of hydro-electric works or similar projects. A sound knowledge of contract procedures and administration.

(c) Road Development. Extensive experience in the planning, including selection of routes, survey, design and construction of road works, preferably in mountainous country.

2. EXECUTIVE ENGINEER, Grade II—£1696/£1944 p.a.

Tunnel Design. Extensive experience in the design of tunnels, pressure shafts and surge tanks for hydro-electric projects and ability to direct the preparation of detailed designs, estimates and specifications for such works and plan field investigations.

3. EXECUTIVE ENGINEERS, Grade I—£1388/£1696 p.a.

(a) Design. Extensive experience in the design of large underground and surface hydro-electric power stations and ability to direct the preparation of detailed designs, estimates and specifications for each works.

(b) Construction. Extensive experience in the construction of hydro-electric works, including planning, the preparation of estimates and works programmes and the forecasting of resources required to carry out programmes.

4. ENGINEERS, Grades I to IV—£764/£1388 p.a.

Experience in investigating, designing and construction, including supervision of construction by contract of hydro-electric works or similar civil engineering projects.

5. ENGINEER, Grade II—£1052/£1100 p.a.

Experience in soil conservation practice over a period of not less than eight years.

6. ENGINEERING GEOLOGISTS, Grades I to III—£800/£1208 p.a.

Experience in general engineering geology and/or petrography with special reference to concretes.

MECHANICAL ENGINEERS

1. EXECUTIVE ENGINEER, Grade III—£2006/£2316 p.a.; or EXECUTIVE ENGINEER, Grade II—£1696/£1944 p.a.

Area Power Plant Engineer. Extensive experience in inspection, installation, commissioning and maintenance of water power plant (turbines, valves, gates, &c.), stationary diesel engines, hydraulic and mechanical plant associated with power projects, design and selection of power plant. Experience also in the mechanical aspect of the above in relation to major electrical generating plant and ability to supervise and direct staff.

2. EXECUTIVE ENGINEERS, Grade II—£1696/£1944 p.a.; or EXECUTIVE ENGINEERS, Grade I—£1388/£1696 p.a.

(a) Power Plant Engineer. Extensive experience in the investigation, design, specification, selection, procurement and testing of water turbines, stationary diesel engines and associated mechanical equipment, and the inspection, installation, operation and maintenance of same.

(b) Hydraulic Plant Design. Extensive experience in the investigation, design, specification, selection, procurement and testing of hydraulic gates (spillway, intake, diversion, draft tube, &c.), supporting frames, lifting and control gears, screens, valves, and pumps.

(c) Area Mechanical Engineer. Extensive general mechanical experience, including direction of major workshops for repair and maintenance of heavy earth-moving equipment and transport vehicles, and the installation and maintenance of mechanical building services, installation and maintenance of permanent power plant, &c.

3. ENGINEERS, Grade I to IV—£764/£1388 p.a.

Mechanical engineering experience in the following fields :—

(a) Design, specification of cranes, haulages, &c.

(b) Design, specification of heating, ventilating equipment, &c.

(c) Operation of base and field workshops for transport and earth-moving plant.

(d) Co-ordination and control of field activities associated with the above.

ELECTRICAL ENGINEERS

1. EXECUTIVE ENGINEER, Grade I—£1388/£1696 p.a.

Extensive experience in the organisation, control and construction of E.H.T. lines up to 330kV. Field experience and ability to organise and supervise construction groups essential.

2. ENGINEERS, Grades I to IV—£764/£1388 p.a.

Electrical power engineering experience in the following fields :—

(a) Layout of primary and secondary installations for hydro-electric power stations and associated switching and terminal stations.

(b) Protection of long H.V. transmission lines, power station and switching station equipment.

(c) Operation and maintenance of large power systems.

(d) Construction of power stations, switching stations and/or transmission systems.

(e) Layout and installation of communication schemes for large power system operation.

SUPERVISING ARCHITECT

ARCHITECT, Grade IV—£1298/£1388 p.a.

Extensive practical experience in supervision of contract work and the administration of contracts. Knowledge of business methods. Experience as contractor on own account preferred.

Except for the last-mentioned position, applicants for which must be qualified architects, the academic qualifications required are a Degree from a recognised University, Corporate Membership of the Institutions of Civil, Mechanical or Electrical Engineers or equivalent professional qualifications.

Subject to certain conditions, including a bond of £100 to remain with the Authority for at least two years, the fares of successful applicants and their dependents will be paid by the Authority. Salaries commence from date of entry on duty in Australia, where temporary hotel or guest house accommodation will be arranged until a flat or cottage can be provided on a rental basis.

Each applicant should state his age, nationality, marital status, present position and salary, and give full and complete particulars of his qualifications and experience.—Applications should be addressed to the Engineer-in-Charge, Snowy Mountains Hydro-Electric Authority, 18, St. George Street, Hanover Square, London, W.1. The Authority cannot undertake to acknowledge all applications. Communications will be sent only to those applicants required to attend for interview. E9439

THE DOCKS AND INLAND WATERWAYS EXECUTIVE

(SOUTH WALES DOCKS)

ENGINEERING ASSISTANT

The Docks and Inland Waterways Executive (South Wales Docks) have a vacancy for an ENGINEERING ASSISTANT in the Civil Engineer's Department at Barry Docks.

Applicants should hold an Engineering Degree and/or be Chartered Civil Engineers. A knowledge of general civil engineering work is essential, preferably on docks and harbours. Salary £594–£669 10s. per annum. The successful applicant will be required to join a contributory superannuation scheme.

Applications, stating age, qualifications, details of past experience and present position, should be addressed to the Chief Docks Manager, Docks and Inland Waterways Executive, Pierhead Building, Cardiff Docks. E9455

NATIONAL COAL BOARD

PRODUCTION DEPARTMENT

ENGINEERING ASSISTANTS

Applications are invited for the appointments of ENGINEERING ASSISTANTS (Building, Civil and Structural) in the Production Department at London Headquarters. Candidates must have had experience in the design and detailing of reinforced concrete framed structures. Preference will be given to candidates with a Higher National Certificate of Graduateship of the Institution of Structural Engineers.

Salary will be between £450 and £750, according to qualifications and experience.

Apply in writing, giving full particulars (in chronological order) of age, education, qualifications and experience (with dates), to National Coal Board, Establishments (Personnel), Hobart House, Grosvenor Place, London, S.W.1, marking envelope TT 489. Original testimonials should not be forwarded. Closing date 18th July, 1952. E9403

HER MAJESTY'S COLONIAL SERVICE

MALAYAN RAILWAYS (27322/257)

ENGINEER, WAY AND WORKS

Applications are invited for the following post :—
ENGINEER, WAY AND WORKS.

Duties : to be in charge of a railway district of about 150 miles and with responsibility for the maintenance of the permanent way and buildings and for supervision of special service works within the district. The post is pensionable and appointment will be on probation in the first instance. The salary scale is 440 dollars to 1000 dollars per month, point of entry being determined by the candidate's war service and professional experience, plus expatriation pay, which is pensionable, 90 dollars to 200 dollars per month.

A temporary cost-of-living allowance is payable, varying from 240 dollars p.m. for a single officer to a maximum of 505 dollars p.m. for a married officer. For purposes of exchange with sterling 1 dollar is equal to 2s. 4d. For example, a married officer, with a child, who has had six years' post-graduate approved professional experience would receive a gross emolument of £1560 per annum.

Candidates should be Corporate Members of the Institution of Civil Engineers or hold an equivalent qualification and should have had experience of civil engineering works on a railway. Experience of modern methods of permanent way maintenance with flat-bottomed rails would be an advantage. First-class passages will be provided for the officer, his wife and up to three children under ten ; home leave on full pay will be granted at the rate of four days for each month's service after a tour of three to four years. Furnished quarters are provided at rents varying between 17.50 dollars and 66 dollars per month, according to the class of quarters. Malayan income tax is payable at low rates.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number 27322/257. E9443

BOROUGH AND COUNTY OF THE TOWN OF POOLE

WATERWORKS UNDERTAKING, CORFE MULLEN PUMPING STATION

APPOINTMENT OF ASSISTANT RESIDENT ENGINEER

Applications are invited for the appointment of ASSISTANT RESIDENT ENGINEER at the Corfe Mullen Pumping Station, Wimborne.

The salary will be at the rate of £355, rising (subject to satisfactory service) by annual increments of £15 to £415 per annum, plus house (rent and rates free), and a fixed allowance of coal and electricity.

The appointment, which is intended to be a permanent one, is subject to the provisions of the Local Government Superannuation Act, 1937, and the successful candidate will be required to pass a medical examination.

The plant consists of steam triple-expansion pumping engines, reciprocating pumps, lime-softening and filtration plant, and electrical pumping machinery.

Applicants, who must be trained mechanics, not over 35 years of age, should have a sound knowledge of steam and electrical machinery ; experience of lime softening plants would be a distinct advantage.

The person appointed must take turns with the resident engineer to be available during day and night for emergency repairs without payment of overtime.

Applications, giving full particulars of experience and qualifications, should be accompanied by copies of two recent testimonials, and forwarded to the undersigned not later than Monday, 21st July, 1952.

Canvassing will be a disqualification.

WILSON KENYON,
Town Clerk.

Municipal Buildings,
Poole,
Dorset,
17th June, 1952. E9423

FIFE COUNTY COUNCIL

COUNTY ENGINEER'S DEPARTMENT, CUPAR

ENGINEERING ASSISTANTS

Applications are invited for appointments as ENGINEERING ASSISTANTS on the following salary grades :—

(a) £650 to £790 per annum.
(b) £530 to £650 per annum.
(c) £480 to £600 per annum.
(d) £405 to £485 per annum.

Applicants for the higher graded posts should be qualified civil engineers, with experience in the design, construction and maintenance of waterworks and/or drainage works. Successful candidates, under 45 years of age, will be considered for admission to the Council's superannuation scheme, subject to a satisfactory medical report being received. Consideration may be given to meeting housing requirements. Applications, stating age, qualifications and experience, with copies of not more than three recent testimonials, to be lodged with the Manager, Ministry of Labour, Preston Lodge, Cupar, not later than 5th July, 1952.

J. M. MITCHELL,
County Clerk.

County Buildings,
Cupar-Fife,
16th June, 1952. E9395

HER MAJESTY'S COLONIAL SERVICE

P.W.D. (27325/28), MALAYA

MECHANICAL ENGINEER

Applications are invited for the following post :—
MECHANICAL ENGINEER, P.W.D. (27325/28), Malaya. Duties include supervision and organisation of staff and workshops engaged in assembly, erection, maintenance and repair of plant and machinery. Appointment is pensionable on probation in the salary scale £742 to £1652 p.a., the point of entry depending on experience and war service. In addition, there is a substantial cost-of-living allowance. Free Passages are provided on appointment and on leave for the officer, his wife and up to three children under the age of ten. Furnished quarters, if available, are provided at reasonable rent. Leave is granted at the rate of four days for each month of resident service in a tour of three to four years. Candidates, between the ages of 23 and 35, must be A.M.I.Mech.E. or have passed or be exempted from Sections A and B of the Associate Membership examination, and should have had three years' training in workshops and drawing-offices with an additional two years' experience in a large engineering works. Knowledge of the maintenance and repair of earth-moving equipment an advantage.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number (27325/28). E9421

HER MAJESTY'S COLONIAL SERVICE

P.W.D. (27325/6) NIGERIA

MECHANICAL ENGINEER

Applications are invited for the following post :—
MECHANICAL ENGINEER, P.W.D. (27325/6), Nigeria. Duties include supervision of the maintenance and repairs of all types of equipment, e.g., road making plant, heavy earth-moving plant, general contractors' plant, waterworks installations, and vehicles. Appointment is on contract in scale £830 to £1450 p.a., point of entry being determined by experience and war service. A cost-of-living allowance is also payable. Furnished quarters, if available, are provided at reasonable rent. Leave at rate of seven days per month of resident service. Free passages for officer, wife and two children under 18 years once each way in each tour of service. An outfit allowance is granted on first appointment. Candidates between ages of 25–50 years must have passed, or gained exemption from, Sections A and B of the Associate Membership Examination of the Institution of Mechanical Engineers or Institution of Civil Engineers in mechanical subjects, and have had at least three years' experience.

Intending candidates should apply in writing to the Director of Recruitment (Colonial Service), Colonial Office, Sanctuary Buildings, Great Smith Street, S.W.1, giving brief details of their age, qualifications and experience. They should mention this paper and quote the reference number 27325/6. E9442

CITY OF LEICESTER

WATER DEPARTMENT

JUNIOR CIVIL ENGINEER

JUNIOR CIVIL ENGINEER required by Water Department of the City of Leicester to assist in the design and construction of works of water supply including aqueducts, service reservoirs and the development of a new source of supply. The appointment is a permanent one and the salary lies within the range A.P.T. I–IV (£440–£575 per annum), depending upon qualifications and experience.

Applicants should have passed Sections A and B of the Institution of Civil Engineers' Examination or should hold an exempting Degree. Practical experience, particularly of works of water supply, is desirable, but not essential.

The appointment is subject to the provisions of the Local Government Superannuation Act, 1937, and to a satisfactory medical examination.

Applications, giving full details of training and experience, should be submitted to the undersigned before 18th July, 1952.

HAL WALLHOUSE,
Engineer and Manager.

City of Leicester Water Department,
Bowling Green Street,
Leicester. E9404

RAUCEBY HOSPITAL, SLEAFORD, LINCS

ENGINEER-IN-CHARGE

Applications are invited for the post of ENGINEER-IN-CHARGE at this mental hospital (552 beds) from persons holding qualifications approved by the Minister of Health (R.M.C. (50) 23). Commencing salary £475 by £20 to £575 (ultimate scale £520 by £20 to £620). An unfurnished house will be available at a charge of 15s. per week. National Health Service superannuation regulations and conditions of service will apply.—Applications, giving full details of qualifications and experience, with two names and addresses for reference, must be received by the Group Secretary, Lincoln No. 3 Hospital Management Committee, Harmston Hall, Lincoln, within 14 days of this notice. E9402

For continuation of Small Advts., page 4

PUBLIC NOTICES

MINISTRY OF SUPPLY

DIVISION OF ATOMIC ENERGY (PRODUCTION)

WORKSHOPS ENGINEER

WORKSHOPS ENGINEER required by the Division of Atomic Energy (Production), Capenhurst Factory, Chester, to supervise workshops engaged in general machining and fitting, fabrication and welding of aluminium pipework and steel structure, and the overhaul and maintenance of machine tools, motor vehicles and mobile plant.

Applicants must have either an Honours Degree in Engineering, Corporate Membership of one of the Institutions of Civil, Mechanical or Electrical Engineers, or equivalent qualification. They must also have served a recognised apprenticeship and have had some years' experience in workshop management. Experience in precision machine work, electric arc and argon arc welding, and a knowledge of modern methods of estimating and cost control would be an advantage.

Salary will be assessed according to qualifications and experience within the range £927–£1218 p.a. There is a voluntary superannuation scheme. Applications to Ministry of Supply, D.AT.EN (P), Risley, Nr. Warrington, Lancs, quoting Reference 355. E9417

TENDERS

LANCASHIRE COUNTY COUNCIL

SOILS TESTING LABORATORY

TESTING MACHINES

TENDERS are invited for the SUPPLY of 200-ton and 10-ton COMPRESSION TESTING MACHINES and APPARATUS for Aggregate Crushing for the Lancashire County Council Soils Testing Laboratory, Freckleton, near Preston.

Forms of Tender and specification may be obtained from the County Surveyor, County Hall, Preston.

Tenders must be forwarded to the undersigned not later than 10 a.m. on Monday, 7th July, 1952, in a plain sealed envelope which must not bear any name or mark indicating the sender.

R. ADCOCK,
E9365 Clerk of the County Council.

SITUATIONS VACANT

NOTIFICATION OF VACANCIES ORDER, 1952

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18–64 inclusive or a woman aged 18–59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

APPLICANTS ARE ADVISED TO SEND COPIES, NOT ORIGINALS, OF THEIR TESTIMONIALS UNLESS OTHERWISE REQUESTED.

A DESIGNER DRAUGHTSMAN is required for interesting work on precision electrical switchgear. This post calls for a man with at least five years' experience in the design of electro-mechanical or similar small precise mechanisms.—Application to be made in writing giving details of education, previous experience and present salary, to Burgess Products Co., Ltd., Dukesway, Team Valley, Gateshead, 11, Co. Durham. E3727 A

A PRODUCTION ENGINEER is required by leading engineering company (Midlands). The appointment is a new one, offering considerable scope, entailing responsibility to the works director. Proved ability and sound practical experience in production study, methods and production development essential. Applications, which will be treated in strict confidence, should give details of age, education, training, appointments held, together with salary expected.—BOX No. E3790, "The Engineer." A

A SENIOR POWER ENGINEER is required by the Bahrein Petroleum Co., Ltd. Applicants must have Degree and/or A.M.I.E.E. qualifications, have over five years of experience in modern steam power stations in a supervisory capacity, and be under 45 years of age. Salary will be in accordance with qualifications and experience, the company providing free board, air-conditioned accommodation and medical attention, with kit allowance and participation in a pension plan. Each agreement is for twenty-four or thirty months, with paid local and home leaves.—Write, with full particulars, to BOX 5596, c/o Charles Barker and Sons, Ltd., 31, Budge Row, London, E.C.4. E477 A

A WELL-KNOWN FIRM of aircraft instrument manufacturers requires a Designer Draughtsman to complete a small development section. He will be required, with assistance, to produce complete drawings at all stages from initial design to production, of a new type of equipment. Experience in light engineering work is necessary, but electrical experience is not essential. Guildford area.—Apply, giving particulars of qualifications and experience.—BOX No. E3809, "The Engineer." A

A.E.C., LIMITED, require Designers and Draughtsmen, preferably having experience of heavy commercial and passenger vehicle chassis units and components.—Applications in writing to Staff Records Office, Windmill Lane, Southall, Middlesex, stating age, experience and salary required. E9354 A

AN IMPORTANT COMPANY engaged on defence contract, requires immediately the services of a first-class Senior Jig and Tool Draughtsman in Gloucestershire.—Apply, with full details of age, qualifications, experience and salary required, to BOX No. A.C. 73090, Samson Clark's, 57/61, Mortimer Street, London, W.1. E9269 A

AN ENGINEERING GRADUATE, with a good Honours Degree, is required by a large and growing manufacturing company. For many years this company has periodically engaged young engineers, with the right basic qualifications and has trained them for specific staff positions, from which they develop into more senior responsibilities according only to their ability. In dealing with applicants the company is looking for the man who is capable of carrying managerial responsibilities as well as the more usual technical and practical work. The basic requirements are Honours Degree, basic workshop experience, and a strong leaning to, and aptitude for, management work in industry. Age range 22–28 years. Initial training within the company, lasting several months, will be given before responsibilities are taken up. After that the candidate's progress will be in accordance with his ability on the job. All higher positions are filled from within the company. An adequate commencing salary will be offered and excellent increments are made to match good progress. Conditions such as superannuation, life assurance, &c., are adequately covered. Replies will be treated in strict confidence. Suitable candidates are invited to forward a brief outline of their careers to date.—BOX No. E3826, "The Engineer." A

AN ENGINEERING GROUP in the Midlands (Coventry and Birmingham) is seeking a first-class Planning Engineer. Must have an all-round knowledge, including hydraulics. Good salary and prospects offered and possibly house accommodation. State full details of experience, which will be treated in confidence.—BOX No. E3829, "The Engineer." A

APPLICATIONS ARE INVITED from Senior and Intermediate Draughtsmen for work in connection with gas and coke oven plants. Varied and interesting work in (a) lay-out and detail of tanks, pipework and special apparatus; (b) general engineering and lay-out of mechanical equipment; (c) design and detail of steel structures, conveyor steelwork, &c. Good salaries to capable draughtsmen. Five-day week, canteen — State age and details of experience to the Personnel Officer (D.O.), The Woodall-Duckham Co., 63/77, Brompton Road, London, S.W.3. E199 A

APPLICATIONS ARE INVITED from Design Draughtsmen and Stressmen, also Technical Assistants with combined design and performance experience for work on both reciprocating and gas turbine aero-engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. E115 A

APPLICATIONS ARE INVITED from men of experience and proved ability for the post of Chief Inspector of a large and progressive light electrical and mechanical engineering company—approximately 3000 employees. Knowledge of modern methods of inspection, assembling and machining, combined with intimate knowledge of I.F.V., C.I.A. and A.I.D. procedure, is essential. Reply in first instance and in confidence.—BOX No. E9332, "The Engineer." A

APPLICATIONS ARE INVITED from Senior and Intermediate Design Draughtsmen; experience of aero-engine design desirable, but not essential. Also Checkers.—Please write, stating age and giving details of previous experience, in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. E116 A

ARMSTRONG SIDDELEY MOTORS, makers of two out of three of England's super priority jet engines, have number vacancies Coventry for experienced Planning Engineers. Aero-engine experience great advantage, general engineering experience possibly sufficient if combined with high-level intelligence. Also vacancies for Factory Layout Draughtsmen and Senior and Intermediate Jig and Tool Draughtsmen. Reply in detail to Reference HDT.—BOX No. E9397, "The Engineer." A

ASSISTANT CHIEF INSPECTOR, age 30–40, required for West London general engineering company. Must be qualified to National Certificate standard and have had previous inspection experience, preferably in a supervisory capacity on work covered by A.I.D. and C.I.A. approval. This post is permanent and carries superannuation. Apply, giving fullest details, training and qualifications, age and salary required.—BOX No. E9385, "The Engineer." A

ASSISTANT DESIGN ENGINEER for gas turbine thermodynamic design calculation and interested in mechanical and structural side required by large firm in the East Midlands. Preference to applicants having served a recognised apprenticeship or at least the equivalent of a year's works experience. Previous gas turbine experience for applicants below 25 years of age not essential. Applications, stating age, qualifications and experience.—BOX No. E9459, "The Engineer." A

ASSISTANT (LAND) SURVEYOR required by London consultants. Age range about 22 to 30. Broad survey experience with theodolite and level at least essential. Work would cover both home and overseas, particularly overseas for comparatively short periods. Please state age and experience.—BOX No. E9453, "The Engineer." A

AUTOMOBILE ENGINEER (road test project). Manufacturing organisation in Outer East London district requires capable and ambitious man, aged not more than 35. Should have served apprenticeship in mechanical engineering and attained at least H.N.C. standard. At least five years' experience in motor industry essential and must have good knowledge of electricity. Acquaintance with electronics an advantage. Salary in accordance with experience and qualifications. Permanent and pensionable post. Reply, quoting ref. RTP.—BOX No. E9440, "The Engineer." A

CHIEF PLANT and Maintenance Engineer. Well-known engineering firm in the North-West area, with 3000 employees, require the services of a Chief Plant and Maintenance Engineer. The successful applicant must be capable of organising installations, maintenance, and overhauling of the plant, including steam generation, mechanical and electrical equipments. Must be capable of drawing up specifications for the maintenance of buildings, &c., and minor structural alterations. Write, stating age, experience, qualifications and present position. Applications will be in strictest confidence.—BOX No. E9366, "The Engineer." A

AUTOMOBILE ENGINEERING FIRM of repute in North-Western area have immediate vacancies for Detail Draughtsmen between the ages of 21 and 25 years of age. These vacancies offer good terms and conditions, also excellent prospects for right type of applicants. Apply immediately, giving as many particulars as possible regarding experience, &c.—BOX No. E506, "The Engineer." A

BRITISH ENGINE BOILER and Electrical Insurance Company, Ltd., 24, Fennel Street, Manchester, 4. The company requires additional Inspectors of Boiler and Engine Plant in a few districts. Permanent positions carrying progressive salary scale £520 to £750 and non-contributory pension. Candidates, age not exceeding 32 years, having steam boiler and engine experience, and possessing at least First-Class M.O.T. Certificate or equivalent qualifications, are invited to apply in own handwriting, stating age, qualifications and experience. E9370 A

CIVIL ENGINEER, aged around 30, having passed A and B of A.M.I.C.E., and with at least five years' experience on site of works involving mass and reinforced concrete foundations and heavy civil engineering products, required for Persian Gulf by a large British concern. Substantial allowances in addition to salary; pension fund; biennial (paid) home leave.—Write, quoting 220, to BOX No. 5958, c/o Charles Barker and Sons, Ltd., 31, Budge Row, London, E.C.4. E9434 A

CIVIL ENGINEERING ASSISTANTS required by Westminster consulting engineers. Must be experienced in the design of one or more of the following:—Harbours and docks, large dams, reinforced concrete and mass concrete structures. Apply, stating age, experience and salary required. —BOX No. E9279, "The Engineer." A

CONSULTING ENGINEERS in Glasgow have vacancies for Civil Engineers and Surveyors for design and construction work in connection with large hydro-electric projects in Scotland and steam power stations in Scotland, England and Northern Ireland. Qualified men with experience this class of work should submit details of training and experience. Remuneration according to qualifications and ability.—BOX No. E3820, "The Engineer." A

DANIEL ADAMSON AND CO., LTD., Engineering Works, Dukinfield, require Draughtsmen in the following categories:—TURBINE DEPARTMENT: Experienced Senior Draughtsmen accustomed to layout work on turbines, blowers, compressors, &c., and capable of acting as Section Leaders. Detail Draughtsmen required also. WATER-TUBE BOILER DEPARTMENT: Senior and Junior Draughtsmen, accustomed to water-tube boiler or general steam plant layout or pipework. Opportunities for experienced Seniors as Section Leaders. Suitable applicants are assured of interesting work with good prospects at an attractive remuneration.—Applications should be addressed to the Company, and the appointments will be subject to Ministry of Labour approval. E9151 A

DE HAVILLAND ENGINE CO., LTD., have the following technical vacancies available in the experimental test beds department of their Hatfield Factory:—Junior Technical Assistants, required for test work in connection with recording and analysing the performance data of development gas turbine engines. Good salaries to suitable applicants. Canteen facilities; five-day week.—Please write, giving age, full details of previous experience and salary required, to the Personnel Officer, The de Havilland Engine Co., Ltd., Hatfield Aerodrome, Hatfield, Herts. E9330 A

DEPUTY CHIEF BUYER required for large engineering company, Glasgow. Capable of handling staff, devising control systems on own initiative, and with wide knowledge of markets and suppliers. Practical experience essential. Salary about £800 or more according to qualifications. Help given with accommodation.—Write full details to 1763, Wm. Porteous and Co., Glasgow. E9394 A

DESIGN DRAUGHTSMAN.—An excellent opportunity occurs for the right man with experience in motor coach work and vehicle heating.—Please apply in writing to Chief Designer, Delaney Gallay, Ltd., Edgware Road, Cricklewood, N.W.2. E3740 A

DESIGN ENGINEERS and Detail Draughtsmen for reinforced concrete, steel structures, concrete and brick foundations, steam and general pipework. Heavy mechanical handling for oil and steel industries. London and South Midland locations. Living allowances paid on site. Positions with permanency. Write age, experience, present salary.—BOX No. E3768, "The Engineer." A

DESIGN ENGINEERS and Detail Draughtsmen for reinforced concrete, steel structures, concrete and brick foundations, steam and general pipework, heavy mechanical handling for oil and steel industries. London and South Midlands locations. Living allowances paid on site. Positions with permanency. Write age, experience, present salary.—BOX No. E3788, "The Engineer." A

DESIGN DRAUGHTSMAN for research and development department of progressive light engineering company in Midlands engaged on hydraulics for aircraft and automobile work. Thorough technical and practical training essential with extensive experience on design work. This is a position of considerable interest and offers excellent prospects. Please quote reference number 1349; state full particulars, experience, age, and salary.—BOX No. E9451, "The Engineer." A

DESIGNERS AND DRAUGHTSMEN, having mechanical and structural engineering experience, required immediately for development work on mobile cranes. Salary in excess of A.E.S.D. rates, according to qualifications. Company owns attractive vacant houses.—Apply by letter to Chief Engineer, R. H. Neal and Co., Ltd., Dysart Works, Grantham. E3806 A

DESIGNER, senior, required for interesting work in development of hydraulic equipment for mechanical handling and contractors' plant. Progressive permanency in a new and expanding field. Must be an experienced practical engineer of good personality, able to initiate and develop his own ideas in conjunction with customers' requirements.—Applications, which will be treated in strictest confidence, must give full details of education, experience, age and salary required, to General Manager, Weston Works (Birmingham), Ltd., Weston Lane, Greet, Birmingham, 11. E3807 A

DESIGNER DRAUGHTSMEN required for work on deep mineral drilling equipment. H.N.C. qualifications. Preferably with some experience of lifting gear. A.E.S.D. rates minimum.—John Thom, Ltd., Canal Works, Patricroft. E3745 A

DESIGNERS AND DETAILERS in reinforced concrete and steelwork required in structural D.O. of chemical and oil engineers; vacancies at various levels. Special scope for young men wanting enlarge experience. Salary according to capabilities. Generous pension scheme and free life insurance.—Write, Chief Engineer, E. B. Badger and Sons (G.B.), Ltd., 40, Parkgate Road, London, S.W.11. E3791 A

DRAUGHTSMAN, aged 25 to 40, required in S.W. London area for design of special-purpose tools and machine details. Applicant must have practical experience of mechanical engineering, together with good theoretical knowledge. State age and details of experience.—BOX No. E3751, "The Engineer." A

DRAUGHTSMAN-DESIGNER, electro-mechanical apparatus, experience of circuit work an advantage.—Apply (quoting Ref. "STE"), Personnel Department, General Electric Co., Ltd., Union Works, East Lane, Wembley, Middlesex. E9166 A

DRAUGHTSMAN required for work on industrial gas turbines. A variety of work of interesting nature covering wide range of gas turbine applications from the process industries to portable power plant. Applications, giving full qualifications, experience—BOX No. E9461, "The Engineer." A

DRAUGHTSMAN. — Competent Designer Draughtsman for Lockheed Hydraulic Brake Co., Ltd., Leamington Spa. Must have sound experience in application of hydraulics to aircraft controls and have reached H.N.C. standard.—Write to Personnel Officer, giving details of experience and qualifications, age and salary required. E9452 A

DRAUGHTSMAN, preferably with diesel engine experience, required for design work under supervision. Superannuation scheme. Good rates. Victoria Street area. State full details and age.—BOX No. E9440, "The Engineer." A

DRAUGHTSMAN for the London area.—Apply, Gwynnes Pumps, Ltd., 64, Chancellor's Road, Hammersmith, W.6. E481 A

DRAUGHTSMAN required by constructional engineers for structural steelwork, fabricated plate-work and vessels. Interesting work, good salary according to age and experience; Feltham area.—BOX No. E3717, "The Engineer." A

DRAUGHTSMAN required, to specialise in equipment and piping insulation in oil refinery work as part of small D.O. section. Some experience in this line essential. Pension scheme, five-day week.—Write or 'phone, Chief Engineer, E. B. Badger and Sons (G.B.), Ltd., 40, Parkgate Road, London, S.W.11. E3794 A

DRAUGHTSMAN, for engineering drawing-office, required. Over 25 years of age, experience in heavy engineering maintenance preferable, but not essential. Must be able to work on own initiative and follow the work into the shops. Good opportunity to widen experience on varied work. Canteen and social club facilities: five-day week.—Apply, Personnel Manager, Tubes, Limited, Rocky Lane, Aston, Birmingham, 6. E516 A

DRAUGHTSMAN required to join modern development eng. dept. of light engineering company for prototype process plant and equipment work. Duties also include experimental work. Applicants must possess at least O.N.C. in Mech. Engineering: advantage if studying or possessing H.N.C. Position offers good starting salary and excellent prospects to a live and enterprising young man. Permanent in nature and pensionable.—Apply to Personnel Manager, The Glacier Metal Co., Ltd., Ealing Road, Alperton. E3815 A

DRAUGHTSMAN (Electrical) required by the Midland Tar Distillers, Ltd., Four Ashes Works, near Wolverhampton, for their new works in the course of construction. Good conditions and interesting work.—Apply through the Ministry of Labour. E9408 A

DRAUGHTSMEN, civil and structural, with some knowledge of design and able to work on own initiative.—Write, stating experience and salary, Brown, O'Sullivan and Partners, 123, Victoria Street, S.W.1. E9463 A

DRAUGHTSMEN required for the plant installation and maintenance department of light engineering company. Applicants must have experience of factory layouts, electrical and mechanical services, and design of simple special-purpose equipment.—Write, giving age and details of experience, to Personnel Manager, Standard Telephones and Cables, Limited, Warwick Road, Boreham Wood, Herts. E9441 A

DRAUGHTSMEN required for (a) detail design and (b) checking drawings of mechanical engineering research equipment.—Apply, giving full details of experience, age and salary required, to Personnel Manager, D. Napier and Son, Ltd., c/o Employment Exchange, Oldhams Terrace, Acton, W.3. E9411 A

DRAUGHTSMEN (two) wanted for the development of mechanisms and machines for film processing. Previous experience in this field not essential, but must have good technical qualifications and knowledge of machine shop or toolroom practice. Consideration will be given to holidays.—Write full details, age and salary required, to Personnel Manager, Technicolor, Limited, Bath Road, Harmondsworth, West Drayton, Middlesex. E3789 A

DRAUGHTSMEN required with experience of electrical control switchgear. First-class working conditions; canteen and sports and social facilities. —Apply, The Labour Manager, Marshall, Sons and Co., Ltd., Britannia Works, Gainsborough. E9315 A

DRAUGHTSMEN, having first-class experience in the preparation of shop detail drawings for coal carbonisation plants and mechanical handling equipment, are required by West's Gas Improvement Co., Ltd., Columbia House, Aldwych, London, W.C.2. E454 A

ELECTRICAL ENGINEER Draughtsman required with experience in the design and installation of power and lighting schemes, distribution and control diagrams, &c. Excellent prospects for suitable men offered by Tees-side firm.—Apply, giving full particulars to Employment Exchange, Stockton-on-Tees. E9380 A

SITUATIONS VACANT

EFFICIENCY ENGINEER.—Large modern power station in London district invites applications from men not more than 45 years of age. Candidates must have had good power station experience, a knowledge of principles of combustion, heat balances, economics of plant operation, and possess at least Higher National qualifications. Non-contributory pension scheme. Commencing salary £950 approximately. Very good prospects for a suitable man. Reply quoting Reference T/EE.—BOX No. E9272, "The Engineer." A

ELECTRICAL DRAUGHTSMAN required by the Midland Tar Distillers, Ltd., Four Ashes Works, near Wolverhampton, for their new works in the course of construction. Good conditions and interesting work.—Apply through Ministry of Labour. E9229 A

ELECTRICAL DRAUGHTSMAN required. Required, diagrams and general layouts, also cable runs similar to power station work. State age, salary required, according to experience.—BOX No. E3760, "The Engineer." A

ELECTRO-MECHANICAL ENGINEERS required, with good academic qualifications, apprenticeship, theoretical background, and knowledge of production methods for development work. Experience in electrical methods of computation, servo theory and instrument design desirable.—Apply, with full details of age, experience and salary required, to the Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. E9196 A

ELECTRONIC ENGINEERS for development work with substantial Birmingham company. Honours Degree in Electrical Engineering or Physics with industrial experience in circuitary and instrument design essential and some practical experience in the application of optics would be an advantage. Five-day week, staff pension scheme, excellent working conditions and sound promotion prospects. Initial salary fully commensurate with qualifications and experience. Applications, which will be treated in confidence, should state full particulars of education and experience.—BOX No. E3818, "The Engineer." A

ELECTRONIC ENGINEERS required for development work in the Gloucestershire area. Good academic qualifications and apprenticeship. Experience in one or more of the following desirable: control systems, D.C. amplifiers, computing devices, video circuits, microwave techniques.—Apply, with full details of qualifications, age and salary required, to BOX A.C. 72916, Samson Clarks, 57/61, Mortimer Street, London, W.1. E9197 A

ENGINEER.—Courtaulds, Limited, require a Chief Services Engineer to work directly under the chief engineer with headquarters in Coventry. Occupant of post will be technically responsible for the specification, layout and operation of all services, including power generation, compressors, refrigeration and air conditioning in all the company's works throughout the U.K. A Degree in Mechanical Engineering and wide practical experience of engineering services essential. Substantial salary.—Candidates should write for a detailed form of application to the Personnel Department, Courtaulds, Limited, 16, St. Martin's-le-Grand, London, E.C.1, quoting the Reference No. B.8. E9368 A

ENGINEERING APPOINTMENT.—Senior Engineer required by light engineering company in London area, to direct development work on ignition equipment for reciprocating and turbine engines. Candidates preferred for this appointment will be qualified engineers who have had practical experience in the applications of such engines, and who can show evidence of ability to control the work of a team. A staff appointment; pension scheme. Applicants should write, quoting Ref. MBE, giving full particulars of their training and experience, and indicate salary expected.—BOX No. E3819, "The Engineer." A

ENGINEERING ASSISTANTS, experienced in the design of structural steelwork, required by consulting engineers in Westminster. Apply, stating age, experience and salary required.—BOX No. E9278, "The Engineer." A

ENGINEERING DRAUGHTSMEN (Junior and Senior) required for I/C engine, marine, jig and tool, also general work.—Particulars, age and experience to Personnel Department, R. A. Lister and Co., Ltd., Dursley, Glos. E9430 A

ENGINEER required for appointment as Production Manager for steel works in Wales. Must have had executive and manufacturing experience, preferably associated with cold rolling and steel slitting. Starting salary £1500, rising to £2000. Pension scheme. Only replies giving full details of age, salary and qualifications will receive consideration.—BOX No. E9450, "The Engineer." A

ENGINEER required for estimating department, centrifugal pump manufacturers. Good technical education required to B.Sc. standard with sound engineering training, including apprenticeship. Experience should preferably include knowledge of estimating and contract procedure relative to centrifugal pumping plant and accessories. Good salary paid to right applicant. Write, giving full details of experience, training and qualifications.—BOX No. E3814, "The Engineer." A

ENGINEER required, to take charge of a small department carrying out technical work in connection with new schemes and modifications to existing plant. Degree (preferably honours) or equivalent is essential and experience with heavy plant is an advantage. Commencing salary approximately £1000 per annum. Please state age and give brief details of career.—BOX No. E3813, "The Engineer." A

ENGINEER required, to take charge of small works dealing with maintenance, reconditioning of contractors' plant and field service of hire machines. Good organiser and disciplinarian, preferably with previous exp., 30/45 years.—Full details of previous exp. and salary required to Wm. G. Search, Ltd., 40/42, Water Lane, Leeds, 11. E9353 A

ESTIMATOR required by W. H. A. Robertson and Co., Ltd., Bedford. Applicants must have practical workshop experience of machining and assembly of medium and large units, and be capable of computing price from both detail and arrangement drawings. Permanent position with good prospects for ambitious young engineer.—Reply, stating age, experience and salary required, to Personnel Officer, Lynton Works, Ampthill Road, Bedford. E3749 A

ENGLISH ELECTRIC Co., Ltd., Luton, have vacancies for a Technical Publications Engineer and Technical Artist. Previous experience is essential. Please write, giving full details of qualifications and experience, and quoting Ref. "English Electric 995," to Westminster Employment Exchange, Chadwick Street, London, S.W.1. E9400 A

ENGLISH ELECTRIC Company, Limited, Luton, require Senior and Junior Designers, capable of working with a minimum of supervision on design and development of hydraulic components, pneumatic components and aircraft fuel systems. Higher National Certificate or equivalent with practical and drawing-office experience essential. Excellent prospects for advancement on a project of the highest priority. Salary £450 to £800, according to age, qualifications and experience. Suitable candidates without the specialised experience stated will be considered as trainees.—Please write, giving full details and quoting Ref. 491C, to Central Personnel Services, 24–30, Gillingham Street, London, S.W.1. E9401 A

ESTIMATOR.—Large firm of contracting engineers, London area, has vacancy in estimating department. Varied and interesting work covering large land and marine boilers, heat exchange equipment, &c. Good salary, commensurate with experience.—Write to BOX 5939, c/o Charles Barker and Sons, Ltd., 31, Budge Row, London, E.C.4. E9321 A

EWBANK AND PARTNERS, LTD., have vacancies for the following:—Electrical Engineering Draughtsmen, experienced in power station and substation distribution systems. Mechanical Engineering Draughtsmen, experienced in power station design and layout, pipework layout, circulating water systems or coal and ash handling plants. Tracers (female), experienced in power station and general engineering work. The positions are permanent and are pensionable. Free lunches are provided and a five-day week is in operation.—Applicants should write in first instance, stating age, details of experience and salary required, to The Secretary, Ewbank and Partners, Ltd., Engineering Consultants, 10/11, Grosvenor Place, S.W.1. E9280 A

EXPERIENCED AND CAPABLE Refinery Piping Draughtsmen-Designers required; also some Detailers. Office organisation allows scope for development of ability and initiative. Pension scheme, five-day week.—Write or 'phone, Chief Engineer, E. B. Badger and Sons (G.B.), Ltd., 40, Parkgate Road, London, S.W.11. E3792 A

EXPERIENCED SPECIALIST Instrument Piping and Installation Draughtsman required for chemical plant and refinery work. Pension scheme, five-day week.—Write or 'phone, Chief Engineer, E. B. Badger and Sons (G.B.), Ltd., 40, Parkgate Road, London, S.W.11. E3793 A

FURNACE ENGINEER required for Sheffield steel works. Applicants should possess University Degree or equivalent, and have had at least five years' practical experience in the design and maintenance of steel works furnaces of all types, including melting, reheating and treatment. Applications, giving details of experience, age and salary required.—BOX No. E3817, "The Engineer." A

GENERAL AND COMMERCIAL Manager required. Must be thoroughly experienced in all branches of re-rolling industry and good knowledge of steel-making. Excellent prospects for suitable man.—Apply, Secretary, Whitehead Iron and Steel Co., Ltd., Newport, Mon. E3770 A

HANDLEY PAGE, LTD., have vacancies for Senior and Junior Assistants of H.N.C. or Degree standard for work in their Mechanical and Structural Test Dept. at Radlett.—Write, stating age and full particulars of qualifications, to Staff Officer, Handley Page, Ltd., Claremont Road, London, N.W.2. E510 A

HANDLEY PAGE, LTD., require a Technical Assistant of Degree or H.N.C. standard to carry out work on thermo-dynamic problems for aircraft air-conditioning and thermal de-icing systems.—Write, stating age and giving particulars of qualifications and experience, to Staff Officer, Handley Page, Ltd., Claremont Road, London, N.W.2. E511 A

INSPECTION MECHANICAL ENGINEER. Applications invited for post of Chief Inspector. The company is in Yorkshire with approximately 2000 employees. Steel, iron and bronze products. Applicant must have good standard of education and must be fully conversant with modern inspection methods. To control staff of 40/50 inspectors. Pension scheme. State salary required. Replies treated in confidence.—BOX No. E3778, "The Engineer." A

JOSEPH LUCAS, LTD., have a vacancy in their development laboratories for a Mechanical Engineer, of Degree or equivalent standard, to undertake design and development work on mechanisms for automobile electrical equipment, with particular reference to starter motor engaging gear. The position is permanent and pensionable and allows a wide scope for personal initiative.—Write, stating age, qualifications and experience, to Personnel Manager, Joseph Lucas, Ltd., Great King Street, Birmingham, 19. E9386 A

JOSEPH LUCAS, LTD., require a young Senior Engineer for the design and development of light electrical equipment with particular reference to small motors and gearboxes. Applicants should have an Engineering Degree, experience in design for large-quantity production, and a knowledge of production methods and techniques. Applicants should be energetic and should have had an engineering apprenticeship. The position is a permanent one and offers excellent prospects for advancement.—Reply, stating qualifications, experience and age, to Personnel Manager, Joseph Lucas, Ltd., Great King Street, Birmingham. E9387 A

JOSEPH LUCAS, LTD., require a young Senior Engineer for research and development of non-linear mechanical and electrical vibrating systems. An Honours Degree in Engineering Science is essential, and it is desirable that applicants should have had an engineering apprenticeship and experience in design for large-quantity production.—Reply, stating qualifications, experience and age, to Personnel Manager, Joseph Lucas, Ltd., Great King Street, Birmingham. E9389 A

MANAGER with good works and executive experience required for small progressive engineering works in Leicester. Initial remuneration and prospects can be discussed with suitable applicant.—BOX No. E3812, "The Engineer." A

LIGHT ENGINEERING FIRM, wide range of products, employing 150, requires Engineer to take charge of method planning, jig and tool design, &c., Sheffield. State age, experience and salary required.—BOX No. E3825, "The Engineer." A

MANCHESTER ENGINEERS, about to open up a new department for manufacture of heavy sheet metal work and light fabrications, require the services of a thoroughly practical Man with managerial capacity to take charge. Applicants must have full knowledge and experience of brake presses, all welding processes, jig design, &c. They must also be capable of advising on the purchase and installation of the necessary plant and machinery. This post offers an excellent opportunity for a first-class man to join an established and rapidly expanding company. Pension scheme available. Applicants should give fullest details of training, experience, previous posts held, also including age, salary and availability.—BOX No. E3827, "The Engineer." A

MARINE ENGINEERING FOREMAN required by Kuwait Oil Company for service in Kuwait. Must have full shipyard apprenticeship and experience of small high-speed diesel engines and be able to repair steel and wood hulls of small craft. National Certificate an advantage. Age 30–40. Salary starting £710 p.a. clear, plus generous allowances, pension scheme and kit allowance.—Write for application form, giving personal details and quoting K.1494, to BOX L/14, at 191, Gresham House, E.C.2. E9413 A

MECHANICAL AND GENERAL Draughtsmen are required with experience of heavy and medium engineering for positions in works drawing-offices in the North of England. Normal hours of employment 38 per week, plus overtime, which is paid for. Salaries according to experience. Apply, stating age, experience and when at liberty.—BOX No. E9300, "The Engineer." A

MECHANICAL ENGINEERING Draughtsman required by London firm in Victoria area. Write, stating details of age, experience, qualifications and salary asked.—BOX No. E3710, "The Engineer." A

MECHANICAL ENGINEER of Degree standard is required for the design and development of small mechanisms and flexible transmissions. Applicants should have experience in design for large-quantity production and a knowledge of hydraulics would be an advantage. The work is varied and provides excellent scope for an energetic young engineer of an inventive nature.—Reply, stating qualifications, experience and age, to Personnel Manager, Joseph Lucas, Ltd., Great King Street, Birmingham. E9388 A

MECHANICAL ENGINEERS required by leading insurance company for London areas. The position is permanent with a salary scale of £520, rising to £750 per annum, with non-contributory pension and contributory widows' pension. Candidates should be between 30–35 years, having served an apprenticeship with subsequent sea service, and must hold at least a First Class M.O.T. Certificate (Steam). Apply in own handwriting, giving age, training and experience. Applicants should reside in the above areas.—BOX No. E3650, "The Engineer." A

MECHANICAL ENGINEERS required by large oil company for service overseas. Candidates must have (a) five years' apprenticeship and possess the Higher National Certificate in Mechanical Engineering, or (b) two years' practical experience with the following: (i) an Engineering Degree and/or (ii) be Graduates or Associate Members of the Institution of Mechanical Engineers. Candidates under category (a) age limit 23–28, under category (b) between ages 23–30; married men under 26 years of age will not be considered for either category. Initial contracts three to four years; commencing salary £620 p.a. upwards, according to age and qualifications; pension scheme benefits and local cost-of-living allowances; £85 outfit allowance; first-class passages provided. Excellent prospects of progressive career.—Apply in writing, giving age, with full particulars of education, qualifications and experience, to BOX Z.V.894, Deacon's Advertising, 36, Leadenhall Street, E.C.3. E435 A

METALLURGISTS required by the Bahrein Petroleum Co., Ltd. Permanency and opportunity for advancement for qualified men. Must have Bachelor's Degree in Metallurgy and several years' practical experience in the determination and cause of stress failures, analytical experience for identification of metals, scales and corrosion products. Commencing salary according to qualifications and experience, the company providing free board, air-conditioned living accommodation and medical attention. Other living costs are low. Agreements are for two-year period with paid local and home leaves. A kit allowance is made for initial tour and a pension scheme is in operation.—Write, with full particulars of qualifications, experience and salary required, to BOX 5243, c/o Charles Barker and Sons, Ltd., 31, Budge Row, London, E.C.4. E107 A

METALLURGIST, to install and operate a pilot plant producing metal ceramic materials for high-temperature applications. Successful completion of this work would lead to promotion to a more senior position in connection with the large-scale production of the material. Applicants should have a Science Degree or equivalent qualifications and preferably a few years' experience of powder metallurgy or ceramic technology. Some knowledge of high-temperature testing methods an advantage. Salary £500–£750, depending on age, qualifications and experience.—BOX No. E9367 "The Engineer."

PETER BROTHERHOOD, Ltd., Peterborough, require Draughtsmen (senior and junior), preferably with experience in design of compressors, turbines and steam engines. Permanent positions, five-day week, staff pension scheme.—Write, giving full details age, experience and salary required. E342 A

PRECISION ENGINEERING CONCERN in Birmingham has vacancies for two Engineers on the staff of their tool standardisation department. Qualifications necessary are a good technical education and experience in the application of jigs and fixtures to precision turning, grinding and gauging. The work requires considerable ability and consists essentially of analysing existing tooling systems with the view to the selection of standards. Apply, stating age, educational and practical qualifications and salary expected.—BOX No. E3808, "The Engineer." A

PLANT ENGINEER, preferably A.M.I.Mech.E. Applicants must be capable of installing new plant, keeping present plant and buildings in first-class condition, and estimating for same. Previous executive positions an advantage.—Write in first instance, to Personnel Manager, Alvis, Ltd., Coventry, giving full particulars of experience and salary required. E9319 A

PRODUCTION ENGINEER required, age between 30–45, for engineering works in Gloucestershire. Applicants should have indentures of apprenticeship and good practical experience. Write, giving particulars of past experience, present work and salary required.—BOX No. E9299, "The Engineer." A

PRODUCTION ENGINEERS, with considerable experience in process planning, jig and tool design, rate fixing and methods study, are invited to apply for a Senior Executive Post in the production division of a large and old-established firm in East Scotland. Products of the group vary from light precision work to heavy industrial machinery of machine tool standards. The post offers excellent scope for a man with organising ability, initiative and knowledge of modern methods of production. Salary will be decided at interview, but it is expected that only an engineer capable of earning a four-figure salary will be suitable for the post. Assistance with housing will be available to the candidate considered suitable. An Engineering Degree or its equivalent would be an advantage, though not an essential qualification.—BOX No. E3764, "The Engineer." A

PROJECT DRAUGHTSMAN required, with experience in modern P.F. fired and industrial water-tube boiler plant. Good remuneration would be offered to a suitable candidate. A pension scheme and a five-day working week are in operation and canteen facilities are available.—Apply to (in writing) Chief Design Engineer, John Brown and Co., Ltd., Land Boiler Division, 8, The Sanctuary, Westminster, London, S.W.1. E9454 A

QUALIFIED ENGINEER wanted for development of special projects. Good technical background and broad mechanical experience essential, together with knowledge of pressure vessels, gas regulation and control. Minimum age 33. Permanent position, London. Salary £750 per annum minimum and according to experience, &c.—Write, BOX No. Q.E.W., c/o Dixons, 1/9, Hills Place, W.1. E9424 A

REINFORCED CONCRETE Designer-Draughtsmen required by consulting engineers, Victoria. Three years' practical experience necessary. Write, giving details and salary required.—BOX No. E3772, "The Engineer." A

REQUIRED by large insurance society, qualified Chief (Maintenance) Engineer, under age 45. Permanent post. Experience elect. mech., boiler plants and buildings as applicable to large blocks of offices and flats in London, &c. Capable of controlling general maintenance staff. Resident within quick and ready access of head office, W.C.1. Commencing salary £700–£750 per annum, according to experience. Superannuation scheme. Applications, stating age, experience and qualifications.—BOX No. E3739, "The Engineer." A

REQUIRED for the Southern Railway of Peru, Locomotive, Carriage and Wagon Senior Draughtsman, 30/35 years of age. Qualifications: must have served a full general apprenticeship in an engineering workshop (preferably railway) and have had at least five years' drawing-office experience with some time in an executive capacity. A knowledge of Spanish an advantage. Future prospects.—Apply to the Secretary, Peruvian Corporation, Limited, 144, Leadenhall Street, London, E.C.3. E485 A

REQUIRED IMMEDIATELY by well-known automobile engineering firm in North-West District, Designers and Detail Draughtsmen, Jig and Tool Draughtsmen, also Planning Engineers. These vacancies offer good conditions and prospects to suitable applicants. Salary according to age, experience and qualifications.—BOX No. E500, "The Engineer." A

RESIDENT ENGINEER required for industrial site in Midlands. Write, stating previous experience and salary required.—BOX No. E3694, "The Engineer." A

SENIOR AND JUNIOR Electronic Engineers required for development of guided missiles and other work of national importance. Good academic qualifications, a thorough knowledge of low-frequency electronic circuits, including D.C. amplifiers, and practical design experience of lightweight electronic equipment are desirable. The posts are pensionable and offer good scope for a man to learn and develop new techniques and advance his position.—Apply to the Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex, giving full details of age, qualifications, experience, and salary required. E9195 A

SENIOR AND JUNIOR Mechanical Engineering Draughtsmen required by company manufacturing diesel-electric locomotives. Experience of the mechanical design of bogies and underframes for electric or diesel-electric locomotives preferred. Excellent opportunities exist for eventual upgrading to Design Engineer. First-class conditions of service, including staff assurance, and good salaries for the right men. Please apply, giving full details of qualifications, training, experience, age, salary, &c.—BOX No. E9376, "The Engineer." A

SENIOR ASSISTANT Civil Engineer required by London consulting engineers. Applicants should have good general design experience, preferably including harbour and dock works and railway layouts, and be able to take full charge of a team of designers. They should also possess an Engineering Degree and be Corporate Members of the Institution of Civil Engineers. Age 35 to 45. Good salary according to qualifications and experience.—Apply by letter only, with full particulars of age, qualifications and experience, to Rendel, Palmer and Tritton, 125, Victoria Street, London, S.W.1. E9416 A

SENIOR CIVIL ENGINEER, with experience in dock and harbour construction, required for overseas. Salary £1700 per annum, plus cost-of-living allowance. Apply, stating age and experience.—BOX No. E9268, "The Engineer." A

For continuation of Small Advts., page 6

SITUATIONS VACANT

NOTIFICATION OF VACANCIES ORDER, 1952.

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18–64 inclusive or a woman aged 18–59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notification of Vacancies Order, 1952.

SENIOR DRAUGHTSMAN required for development work special-purpose machines, light and medium heavy. Applicant must be capable of complete design from engineers' data and sketches. Knowledge of glass an advantage. Minimum salary A.E.S.D. Excellent opportunity for right man.—BOX No. E436, "The Engineer." A

SENIOR DRAUGHTSMAN required by consulting engineers, London; accustomed to food factory plant layout. Age within range of 35/45 years preferred. Salary £630/£720 per annum, according to experience.—BOX No. E3787, "The Engineer." A

SENIOR DRAUGHTSMEN required in Manchester, 25 years of age and upwards, experienced in the design and detail of mechanical handling plant and structural steelwork. General engineering training to H.N.C. standard preferred. Good salary. Production bonus in operation.—Apply to "E" Department, West's Gas Improvement Co., Ltd., Albion Ironworks, Miles Platting, Manchester, 10. E138 A

SENIOR INSTRUMENT ENGINEER, with several years' experience of the application of industrial instruments in large-scale process plants, is required by contracting and consultant organisation for position in London office. An attractive salary will be paid to the successful candidate.—Application with full details of career should be addressed to Head Wrightson Processes, Limited, 24/26, Baltic Street, London, E.C.1. E9409 A

SENIOR PLANNING and Construction Engineer required by large manufacturing organisation with works throughout Britain for designing, co-ordinating and supervising civil and structural work in connection with the development and building of new factories for housing mechanical and chemical plant. Applicants should be aged 25/40, with Honours Engineering Degree and/or Corporate Membership of the Institution of Civil Engineers and Institution of Structural Engineers.—Apply in writing, stating age, qualifications, experience and salary required, to BOX N 5590, A.K. Advg., 212A, Shaftesbury Avenue, W.C.2. E9378 A

SPECIAL-PURPOSE MACHINE and Jig and Tool Designers required by engineering consultants in London. Salary £600 p.a. or above, according to ability.—BOX No. E3533, "The Engineer." A

SPERRY GYROSCOPE CO., LTD., Great West Road, Brentford, Middlesex, require Senior Draughtsmen, (a) electronics, and (b) with precision electro-mechanical experience; Junior Draughtsmen, for detail and assembly work.—Write, with full details, age and salary required, to The Personnel Manager. E399 A

STAFF FOREMAN wanted by Manchester engineering company for works maintenance. Mechanical experience in upkeep of machine tools essential and electrical experience an advantage. Pension. Apply, stating in confidence age, full details of previous experience and salary required.—BOX No. E513, "The Engineer." A

STAFF required for experimental work in connection with combustion and heat transfer in boilers. Whilst there would be considerable scope for men experienced in this field and with university qualifications, openings also exist for younger men interested in engineering who possess a School Certificate or the equivalent. Applicants must either be exempt from or have completed National Service. Commencing salary according to age, qualifications, &c. Five-day week, superannuation scheme.—Apply in writing, quoting reference No. A.15, to the Assistant Secretary, B.C.U.R.A., Randalls Road, Leatherhead. E9456 A

STRUCTURAL ENGINEER wanted for London consulting engineers' office with good practical experience in the design and detailing of steel bridges and structural steelwork generally. Must be thoroughly conversant with fabrication methods, including welded construction, and able to supervise work in assistant designers and detailers. Candidates should preferably possess an Engineering Degree and be Members of the Institution of Civil Engineers and/or Structural Engineers. Age range 35 to 45. Salary according to qualifications and experience.—Apply in writing, with full particulars of age and experience, to Rendel, Palmer and Tritton, 125, Victoria Street, London, S.W.1. E9433 A

STRUCTURAL STEELWORK detail Draughtsman required in Manchester. Good salary; production bonus in operation.—Apply to "E" Department, West's Gas Improvement Co., Ltd., Albion Ironworks, Miles Platting, Manchester, 10. E147 A

SUTCLIFFE, SPEAKMAN and Co., Ltd. Engineers, Guest Street, Leigh, have a vacancy for a qualified Mechanical Engineer, to act as Technical Assistant; age 30 to 35 years.—Particulars and application form from the above address. E3824 A

THE GENERAL ELECTRIC CO., LTD., Brown's Lane, Coventry, have vacancies for Development Engineers, Senior Development Engineers, Mechanical and Electronic, for their development laboratories on work of national importance. Fields include microwave and pulse applications. Salary range £400–£1250 per annum. Vacancies also exist for Specialist Engineers in component design, valve applications, electro-mechanical devices and small mechanisms. The company's laboratories provide excellent working conditions with social and welfare facilities. Superannuation scheme. Assistance with housing in special cases.—Apply by letter, stating age and experience, to the Personnel Manager (ref. CHC). E8703 A

TECHNICAL CLERK, having served a recognised apprenticeship with Higher National Certificate or equivalent, required in gas turbine department, to take charge of all drawing-office records and responsible for issuing instructions to works. Good opportunity for progressive type of man willing to accept responsibility. Applications, stating age, experience and qualifications.—BOX No. E9460, "The Engineer." A

THE BRITISH STEEL PILING Co., Ltd., require a Senior Engineering Assistant for their London office. Applicants should be aged about 30 to 40, and must have professional qualifications with first-class experience in the design of steel and reinforced concrete structures and foundations. Knowledge of soil mechanics (but not necessarily of piling) is essential. The successful applicant will be required to conduct correspondence and discussions with the company's clients and to take charge of the technical staff under the general supervision of the directors. The position, which is pensionable on retirement, offers excellent prospects.—Apply in writing only, giving an indication of the salary required, and marking the envelope "Technical Assistant," to The British Steel Piling Co., Ltd., 10, Haymarket, London, S.W.1. E3828 A

THE SHELL GROUP of Oil Companies have vacancies for Mechanical Engineers with University Degrees and wishing to make a career in the oil industry, in the following departments:—(a) Research at their Thornton research centre near Chester, for which a good Honours Degree is essential, and preferably some post-graduate research experience. This work is likely to be in the United Kingdom only. (b) For engineering and operational work in the Group's refineries in Great Britain (chiefly at Shell Haven, Essex, and Stanlow, Cheshire) and overseas. Candidates should be not over 30 and not liable for national service. (c) Oilfield engineering work overseas in the tropics. For service overseas tours vary from two to four years, dependent on the area. The starting salary for overseas would be according to qualifications and experience. For service in the United Kingdom the starting salary for First and Second-Class Honours Graduates will not be less than £550 per annum, or if Third-Class, £500 per annum, plus additional remuneration for any appropriate post-graduate industrial experience. Full details will be given at interview.—Write in the first instance, giving particulars of academic qualifications, age and experience, to BOX Z.Y.591, Deacon's Advertising, 36, Leadenhall Street, E.C.3. E9343 A

TOOL ROOM FOREMAN wanted by large engineering company in South Manchester. Must be familiar with modern tool room methods, accurate measurement, and use of jig borer. Good organiser and disciplinarian essential. This is a staff appointment and the conditions of employment are attractive. Apply, stating age, full details of previous employment and salary required.—BOX No. E469, "The Engineer." A

TRAVELLER wanted on good commission rates for progressive painting brush firm in all large towns. Only selling to actual users of paint, not merchants or shops. Gentlemen calling on these trades or wishing to sell to engineers, builders, factories, &c., please write, stating area and references. Good permanent position offered. No experience of line necessary. Address in confidence.—BOX No. E515, "The Engineer." A

TWO LEADING ELECTRICAL Draughtsmen or Designers required for Tees-side, experienced in design, layout and installation of complete electrical equipment for gas, chemical and blast-furnace plants. Excellent prospects for experienced men. Accommodation arranged.—Apply, sending full particulars, to Employment Exchange, Stockton-on-Tees. E9384 A

TWO REINFORCED CONCRETE Draughtsmen wanted, fully experienced in the design of R.C. structures, foundations and other civil work. Excellent prospects and salaries for men with initiative, required by old-established Tees-side firm. Accommodation arranged.—Apply, sending full particulars to Employment Exchange, Stockton-on-Tees. E9383 A

TWO SECTION LEADER Structural Draughtsmen wanted for Tees-side, capable of designing steel-framed buildings, structures, trestling, pipe bridges, &c., in conjunction with blast-furnace and other heavy engineering and chemical plant. Detailers also required. Accommodation arranged.—Apply, stating full particulars, to Employment Exchange, Stockton-on-Tees. E9381 A

WANTED as Chief Draughtsman, Design Engineer with supervisory experience, permanent salaried position with established engineering contracting firm specialising in design and construction of coal washing plants. Broad experience in material handling systems essential. Kindly submit details of experience, age, salary required, and starting date. All replies strictly confidential.—The Birtley Company, Limited, Market Place Chambers, West Bars, Chesterfield. E3830 A

WANTED, an experienced Mechanical and Electrical Engineer, for senior post with a large manufacturing firm in Ireland. Age 50 to 55, and applicants should have a University Degree or membership of the Institutions of Electrical or Mechanical Engineers. He would be required to control, supervise and organise the engineering staff and trades operating the works. A knowledge of chemical engineering would be an advantage. Salary £2000 to £2250, according to experience, plus cost-of-living bonus. Good prospects for further advancement. Applications, with full particulars of training and experience.—BOX No. E3822, "The Engineer." A

WANTED, Junior Designer-Draughtsman, for precast and prestressed concrete work; age 22–25. Applicants must have some experience in reinforced concrete design and sufficient technical knowledge to acquire prestressed concrete design quickly. Preference will be given to a man with previous training in mechanical office. Salary according to age and experience.—Apply, The Chief Designer, Dow-Mac (Products), Ltd., Tallington, Nr. Stamford, Lincolnshire. E9426 A

WANTED—Buxton area—Three Assistant Mechanical Engineers, between 30 and 40 years of age, preferably with Honours Degree and experience in mechanical handling and/or knowledge of the cement and lime burning industries.—BOX No. E9412, "The Engineer." A

WANTED, by old-established, continuously expanding company on Tees-side, two Section Leader Draughtsmen, experienced in the layout and design of gas, chemical, oil refining and similar speciality plant. Applicants should have sound knowledge of mechanical design, pressure vessels instrumentation, &c. Position also available competent Detailers. Accommodation arranged.—Apply, giving complete particulars, to Employment Exchange, Stockton-on-Tees. E9382 A

WORKS ENGINEER required for heavy engineering factory in Manchester area. To take charge of maintenance of machine tools, steam and electric power, and general works upkeep. The position is permanent to the right man and is liberally pensioned. Apply, stating age, full details of previous experience and salary required.—BOX No. E512, "The Engineer." A

WORKS INSPECTOR required by large engineering firm in S.E. London area. Applicants should have a thorough knowledge of welded fabrications and pressure vessels. Permanent position; superannuation scheme; canteen, sports and welfare facilities. Apply, stating age, experience, qualifications and salary required.—BOX No. E3773, "The Engineer." A

YOUNG MAN required, not over 30, as a Technical Assistant to the Plant Engineer of the maintenance department of a large electrical and mechanical manufacturing organisation in Liverpool area. Applicants should have sound electrical and mechanical knowledge and some practical experience, preferably in a supervisory capacity, in the maintenance of plant and equipment in a manufacturing organisation. University Degree or Graduate Membership of I.Mech.E. would be advantageous, but is not essential. Permanent post with good salary, contributory superannuation fund and good prospects.—Apply in writing to BOX No. 658, Dorland Advertising, Ltd., 18/20, Regent Street, London, S.W.1, giving details of age, experience and qualifications. E9396 A

YOUNG WELDING ENGINEER required with experience of wide range of welded pressure vessels to all codes. Applicants should have had drawing-office and workshop experience, and be capable of taking up responsible position in office Reply, giving full details and salary required.—BOX No. E3752, "The Engineer." A

SITUATIONS WANTED

A.M.I.MECH.E. (37), considerable drawing-office experience in several fields of engineering, including structures, open to immediate engagement.—BOX No. E3797, "The Engineer." B

B.SC., A.M.I.E.E. ((27), emigrating to Canada later this year, wishes to contact firms requiring Canadian representation. Eight years' experience design and development, electronics, cables, transformers, mercury arc rectifiers, some sales experience. Prepared to undergo initial training in principal's works if required.—BOX No. E3795, "The Engineer." B

CHARTERED ENGINEER, M.I.Mar.E., M.N.E.C.Inst., desires Executive position in London. Experience covers executive positions in factory management, design and general sales. Wide range of contacts in industrial and marine fields at highest levels.—BOX No. E3839, "The Engineer." B

CHIEF OF PRODUCTION CONTROL and progress in large engineering works producing engines, generating plant, &c., is contemplating change. Fully acquainted with the Gantt system of planning and capable of installing same. Over twenty years in present employ. References.—BOX No. E9429, "The Engineer." B

ENGINEER/AGENT (36) requires position with firm of repute. Available immediately; own car; 16 years' experience building and civil engineering industry on large contracts in many parts British Isles.—BOX No. E3801, "The Engineer." B

ENGINEER (27), Grad. I.Mech.E., college education, eleven years' experience of mechanical and production engineering in light industry. Ambitious, desires post of responsibility with prospects.—BOX No. E3803, "The Engineer." B

ENGINEER, many years in executive position at well-known ship repair yard in one of principal ports of South America, seeks employment in this country. All-round experience to offer and can speak Portuguese fluently with working knowledge of Spanish.—BOX No. E3838, "The Engineer." B

MACHINE SHOP SUPERINTENDENT (37), H.N.C. in Mech.Eng., A.M.I.S.E., for the last 11 years employed with large marine engineering firm on diesel engine production as rate fixer, foreman, head foreman, shop superintendent, seeks position in Glasgow area.—BOX No. E3840, "The Engineer." B

MAINTENANCE ENGINEER (42) requires permanent situation. Experience includes extensive boiler plants, repair shops, locomotives, factory services, heavy refrigeration and chemical plant. Accustomed to D.O. supervision, factory layout, plant installation, building construction and maintenance, A.C. and D.C. motors and switchgear; 16 years' experience as works engineer.—BOX No. E3763, "The Engineer." B

MECHANICAL ENGINEER (A.M.I.Mech.E.), experienced draughtsman, will undertake design from rough sketches of data, details, tracings, prints. Consultations arranged. All inquiries receive prompt personal attention.—BOX No. E3796, "The Engineer." B

MECHANICAL ENGINEER (38), public school, H.N.C., at present chief inspector, desires position, Technical Representative or Sales at home or preferably abroad. Widely travelled, prepared to undergo specialised training. Excellent health.—BOX No. E3799, "The Engineer." B

PARTNERSHIPS

ADVERTISER, gentleman (37), has several thousand pounds for investment as Working Director, Partner or Agent in any sound enterprise offering worthwhile interesting outside work; manual included, plus administrative duties; home or abroad.—BOX No. E9466, "The Engineer." A

AGENCIES

AGENTS required for Scottish manufacturer with established and well-advertised products. Good connection essential with engineering concerns.—BOX No. E3786, "The Engineer." A

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ENGINEERING BUSINESS for Sale, old established, London area. N.P. £6000 p.a. Freehold. Price £30,000 all in.—Apply, Clarke and Clarke, 11, New Bond Street, London, W.1. E3841 A

FOR SALE FREEHOLD, modern ground-floor Factory. Floor space 30,000 sq. ft., situate close to station, about ½ hour distance from London. Equipped with first-class precision engineering plant and machinery and fully occupied and engaged on priority work, with further room for expansion on 2½-acre site. All services. Further particulars.—BOX No. E9372, "The Engineer." A

GENERAL AND LIGHT ENGINEERING, South Coast, having Admiralty and Air Ministry contracts. Many valuable agencies, cord rim and Dagenite batteries, &c. Certified turnover £17,000 p.a. Price, to include all machinery, vehicles, agencies and property, £26,000.—Details, National Business Agency, Ltd., 63, Elm Grove, Southsea ('Phone, Portsmouth 5041). E3832 A

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PATENTS

THE PROPRIETORS of Patent No. 588,091, for "Irreversible Transmission," desire to secure commercial exploitation by licence or otherwise in the United Kingdom.—Replies to Haseltine Lake and Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2. E9437 H

THE PROPRIETOR of British Patent No. 538,082, for "Cotton Harvester," desires to enter into negotiations with a firm or firms for the Sale of the Patent or for the grant of Licences thereunder.—Further particulars may be obtained from Marks and Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2. E9448 H

THE PROPRIETOR of British Patent No. 520,762, for "Improved Device for Stabilising High-Speed Turbine and like Rotors," desires to enter into negotiations with a firm or firms for the Sale of the Patent or for the grant of Licences thereunder.—Further particulars may be obtained from Marks and Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2. E9447 H

THE PROPRIETORS of British Patent No. 620,126, for "Improvements in and Connected with Steering Means for Trailers, Semi-Trailers and like Vehicles," desire to enter into negotiations with a firm or firms for the Sale of the Patent or for the grant of Licences thereunder.—Further particulars may be obtained from Marks and Clerk, 57 and 58, Lincoln's Inn Fields, London, W.C.2. E9446 H

SUB-CONTRACTING

CITY AVAILABLE for castings, ma-, assembly, or for the production of complete ts. Modern plant of 400 employees.—BOX 3785, "The Engineer." MW

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GNERS of electrical and mechanical appa- Drawing-Office Capacity available. Proto- manufacture and light assembly in our own hop.—Drawing Office Technical Service ished 1934), 43, Fore Street, Hertford (tele- 3439). E3783 MW

HAN PRECISION TOOLS and Products, of Horley, Surrey, manufactures Plastic s, Jigs and Fixtures, Press Tools, Special- Machines, &c.—'Phone, Horley 909. E122 MW

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ENTORS and/or Producers who wish to pecialise New Ideas with everyday demand rited to communicate with well-known mall organisation.—Write, S.G.R., 446, Salisbury e, London Wall, E.C.2. E9465 MW

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MISCELLANEOUS

FREE !—Brochure giving details of courses in Mechanical and Production Engineering Draughtsmanship, &c., for the A.M.I.Mech.E., A.M.I.P.E., City and Guilds and other professional examinations. Train with the Postal Training College operated by an industrial organisation. Moderate fees.—E.M.I. Institutes, Postal Division, Dept. E30, 43, Grove Park Road, London, W.4 (Chiswick 4417). (Associate of H.M.V.) E104 I

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EDUCATIONAL

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For continuation of Small Advts., page 8

BOOKS and PUBLICATIONS

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COMPANY MEETING

IMPERIAL CHEMICAL INDUSTRIES LIMITED

YEAR OF OUTSTANDING PROGRESS

VITAL IMPORTANCE OF CAPITAL PROGRAMME

MR. J. ROGERS ON CURRENT TRADING CONDITIONS

THE 25th annual general meeting of Imperial Chemical Industries, Ltd., was held on June 19th at Wigmore Hall, 36, Wigmore Street, London, W.1.

Mr. J. ROGERS, O.B.E., LL.D., the chairman, presided and in the course of his speech said :—

As the report shows, the company has again broken records, both in turnover and in profits. It is true that some part of the increase in turnover is due to rising prices, but the physical volume of turnover has also increased to record levels.

Just as part of the increase in money turnover is due to rising prices, so part of the increased trading profit is due to this cause. There is room for differences of opinion among experts as to how profits should be computed and shown in accounts, when part of the surplus which is brought out by normal accountancy methods is represented by the increased carrying prices of stocks of raw materials and finished products. The course which the directors have followed is to leave the methods of stock valuation unchanged, but to make a special appropriation out of net profits of a sum roughly equal to the increased holding values of stocks at the year end due to increased prices and costs. In so far as it requires more cash to hold the stocks which are needed to carry on our business, the part of the profits absorbed by these increased holding values should not, in our opinion, be treated as a profit available for distribution, but should be set aside as a necessary retention of the additional working capital required. For these reasons the Board decided that a sum of £7,000,000 should be transferred to the stock replacement reserve, which will then stand at £11,000,000. If in future years prices do not continue to rise, further provisions of this kind will be unnecessary, and if prices fell, it would be quite proper to bring part of this reserve back into the profit and loss appropriation account.

REPLACEMENT OF FIXED ASSETS

For the replacement of fixed assets the directors have followed the course adopted in 1950 of charging against profits depreciation based upon the company's manufacturing assets as revalued, and of making a further provision out of profits towards the full cost of replacement. The sum of £5,000,000, which has been appropriated out of the net profits for the year 1951 for transfer to the obsolescence and replacement of assets reserve, is the same amount as that provided for 1950.

These appropriations to the stock replacement reserve and to the obsolescence and replacement of assets reserve have been made in order to guard the physical volume of the company's assets from the ravages of inflation, and the Board consider that only after such transfers have been made is there a balance of profit available for distribution and the further building up of the company's reserves. As the accounts show, it is possible to make these provisions for the year 1951, to pay a final dividend of 10 per cent. on the Ordinary stock, making 13 per cent. for the year, and still to leave a small increase in the balance on the profit and loss appropriation account.

SHAREHOLDERS ENTITLED TO CONSIDERATION

It is the considered opinion of the directors that, after full provision has been made for the proper maintenance of the productive assets of the company, stockholders should be given, by way of increased dividends, some part of the increased profits due to the progressive expansion of the company. The total Ordinary dividend for 1951, 13 per cent., before taxation, is still smaller in purchasing power than the dividend of 8 per cent. paid for a number of years before and during the war. Wage earners and salary earners get increases which help to compensate them for the increased cost of living, and it is not unreasonable to consider stockholders in the same way. A large number of the company's Ordinary stockholders are persons of small means, and the increase in cost of living brings hardship to them as well as to wage and salary earners, and the Board do not subscribe to the doctrine, popular in some circles, that Ordinary stockholders in large companies are entitled only to some fixed dividend, regardless of the results of the company's operations. Those who support the company with their savings are entitled to share in the company's prosperity.

I referred last year to the unsuccessful application, which was made to the Capital Issues Committee in April, 1951, to capitalise a substantial part of the company's reserves by the issue to stockholders of shares credited as fully paid, in order to bring the share capital more into line with its true value. No attempt has yet been made to renew this application, but the directors propose to raise the matter again when conditions are suitable.

INCREASE IN AUTHORISED CAPITAL

The company's existing authorised capital of £95,000,000 has now been issued with the exception of some £270,000, and the Board are therefore recommending the stockholders at this meeting to pass a resolution increasing this authorised capital to £120,000,000. The stockholders are also being asked to approve an amendment of the company's Articles of Association, which will give the directors power to decide, at the appropriate time, in what form any new share capital should be issued. I do want to emphasize, however, that these are formal steps and that the Board have no present intention of issuing any part of this new authorised capital.

RECORD OF PROGRESS

As you will have seen from the report, the company's record for 1951 is one of outstanding progress. That progress continues, and the directors have before them no shortage of important and profitable schemes of expansion and development in which the company's resources can be employed. Many of these schemes arise from years of patient and well-directed research. The programme of capital extensions for the next two or three years, however, will have to be held back, in part, at any rate, because of the shortage of essential equipment and building resources for which, quite properly, priority is being given to rearmament.

Exports are as important, or almost as important, as rearmament. The company's direct exports are now running at well over a million pounds a week. In addition to the company's direct exports, it has to be remembered that a substantial proportion of our products goes to other industries which are producing for export. For this reason it is in the interests of the country, as well as of the company, that our capital programme should be pressed forward with no more delay than is absolutely necessary during the present crisis conditions. Another reason for pressing on with this programme is that we must keep ahead of foreign competition.

I have said that we have no shortage of important and profitable proposals for capital expenditure. Indeed, the Board have been aware for some time of the need to be selective and to concentrate upon those projects for which the company is particularly well placed, having regard to its accumulated experience and its large and specialised research and development organisation. The company's forward capital programme is, therefore, under constant review.

FUTURE TRADING PROSPECTS

So far as our future trading prospects are concerned, I should be unwise if I attempted any prophecy to-day. 1952 has brought new problems to some industries which a year or two ago were having difficulty in finding enough materials and labour to cope with an excessive demand, but which to-day are unable to find adequate markets either at home or overseas for their output. The setback in the textile industries, for example, is not a problem peculiar to this country, but is worldwide, and this setback inevitably affects the demand for dyestuffs. For other industries there has been similar change from anxiety about raw materials to anxiety about markets. Nevertheless, it is difficult to interpret these signs as foreshadowing a general depression. So far in 1952 we have not been seriously affected by these conditions and our turnover has been satisfactory, notwithstanding the resurgence of German and Japanese competition. The directors remain, however, keenly alive to the need to watch changes in trading conditions, both at home and overseas, and to adapt ourselves quickly to these conditions. We are fortunate in that our business is so widely spread and covers such varied products that we are liable to be less generally affected by adverse conditions, compared with those industries whose activities are concentrated on a smaller range of products. Nevertheless, we have to be watchful all the time and prepared to meet increasing competition in various parts of the world.

E.P.L.—A HARMFUL TAX

I am confident that we can meet this competition and that we shall continue to expand our business in spite of the obstacles to expansion placed in our way, and in the way of other progressive companies, in the form of penal taxation, which seems almost to have been designed to encourage stagnation and to prevent progress. I refer, in particular, to the new excess profits levy. The chairmen of almost all important companies who have had the opportunity of making public statements since the announcement of this levy have condemned it as a most unwise piece of legislation, which cannot fail to do great harm to Britain's trade and industry, and I am in complete agreement with this condemnation. Whatever the yield of this tax and whatever its purpose in terms of party politics, this tax, even in its modified form, will do much more harm than good to the country, and it is bound to hit hardest those progressive companies whose activities are most likely to assist the country to get out of its present economic troubles, particularly those engaged in the export trade.

The report and accounts were adopted.

The proposed alteration to the Articles of Association was approved and the proposal to increase the company's capital from £95,000,000 to £120,000,000 by the creation of £25,000,000 unclassified shares of £1 each was sanctioned.

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We are buyers of—and carry the largest stocks in the country of :—
MACHINE TOOLS
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We offer the highest prices for surplus Machines for outright purchase, or in part exchange.
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E143 F

600
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We are interested in purchasing good secondhand Plant and Machinery, e.g.

GENERATING SETS
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HYDRAULIC PRESSES
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PLANT for CHEMICAL, OIL, FOOD, RUBBER, PLASTIC and OTHER INDUSTRIES

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MOBILE CRANE wanted, preferably on pneumatics or lorry mounting.—BOX No. E9282, "The Engineer." F

WANTED, all types of modern motorised Machine Tools. Offer your surplus to us and obtain the best prices.—Norman E. Potts (Birmingham), Ltd., 105, Alcester Road South, Birmingham, 14. E123 F

WANTED, Transfer Moulding Press, not less than 150 tons power, preferably about 300 tons.—BOX No. E3810, "The Engineer." F

WANTED, one second-hand "Herbert" No. 7A Preoptive Head Turret Lathe, or slightly larger; electric supply 400/3/50 cycles supply.—BOX No. E9457, "The Engineer." F

10-TON CAPACITY Geared Bottom Pouring Steel Ladle required.—Full particulars and price to Brockhouse Castings, Ltd., Hall Street, Wednesfield, Wolverhampton. E3821 F

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DIESEL GENERATING SETS

Complete contents of power station, comprising : Two 1250 B.H.P., vertical, 6-cylinder, solid-injection, 2-cycle, single-acting, super-scavenge Sulzer Diesel Engines, by Cammell Laird, 428 r.p.m., each direct coupled to a brand new 1060kVA., 850kW., 2-bearing alternator, by Pellizzari and Figli, wound for 440 volt/4 wire, or 3300 volt, three-phase, 50 cycles, with overhung exciter.
Complete with switchgear, air starting equipment, exhaust systems, water cooling tower and softening plant, fuel storage tanks, instruments, valves, gauges, piping, tools and spares. Engines installed by Sulzer Bros. in 1948, the alternators brand new, delivery from makers in three months.

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BRAND NEW RUBBER-COVERED CONVEYOR BELTING
IMMEDIATE DELIVERY
480ft. by 20in. wide by 5-ply, covered 1/16in. top and bottom, grade "A."
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DYNAMO in excellent condition, makers Wm. Walters (Bath), Ltd., 110 volts, 200 amps., 850 r.p.m. Best offer over £40.—Park Farm Preserves, Ltd., Winchcombe, Glos (Telephone Toddington 212). E3798 G

FOR SALE

600
MACHINE TOOLS

Edgwick 18in. PRODUCTION MILLER, motorized 400/3/50, spindle speeds 29–600 r.p.m. by slip-on gears, table working space 7¼in. by 27in.
Richmond model 03 Plain Horiz. MILLER, motorized 400/3/50, 6 spindle speed 18–365 r.p.m. by encl. cones and gear, table working space 38in. by 9in.
Precimax model PL., 6in. by 24in. Plain CYL. GRINDER, motorized 400/3/50, variable speed workhead, hydraulically op. table, variable speed control.
Newall 10in. by 24in. Plain CYL. GRINDER, motorized 400/3/50, variable hyd. reciprocation to table, variable speed to workhead, motorized D.C. from static converter at rear.
9in. GAP BED S.S. and S.C. CENTRE LATHE, single pulley drive from geared head, 9ft. between centres, No. 4 M.T., swing in gap 34in. diam. by 11¼in. in front of face-plate, 9 spindle speeds 8–280 r.p.m.
Lang 10in. by 48in. GAP FLAT BED LATHE, arranged motor drive, 38in. swing in gap, 4 spindle speeds to 193 r.p.m.
European GAP VEE BED S.S. and S.C. LATHE, motorized 220/380/3/50, 6-kW. to five-speed gearbox, double back geared cone head, 11¼in., centre height (24in. swing over bed), admits 10ft. B.C., fitted Norton type gearbox.
Asquith 7ft. RADIAL DRILL, low base, central thrust, motorized 100V D.C., 3 geared spindle speeds with tapping reverse, No. 5 M.T., table working space 8ft. 6in. by 4ft. 6in., column 17¼in. diam. by 15ft. 6in. high.
Swift 6ft. RADIAL DRILL, F. and L. pulley drive, encl. base mounted gearbox, 16 speeds 20–290 r.p.m., working space of "T" slotted base 5ft. 8in. by 3ft. 6in., spindle bored No. 5 M.T.
Asquith 6ft. Central Thrust RADIAL DRILL, F. and L. pulley drive through base gearbox, 18 spindle speeds 8.5–400 r.p.m., spindle No. 5 M.T., six selections feed range 100–30 C.P.I.
White SWARF CRUSHER, 21in. aperture, claw and comb. crushing, motorized 400/3/50.
T.M.A. PANTOGRAPH ENGRAVING M/C., motorized 400/3/50, six speeds to cutter spindle by "V" pulleys, tee slotted table, working space 24in. by 9in., max. throat 30in., eight rows copy plate, equipment.
Beche- Pneumatic DIE FORGING HAMMER, Model LG8, tup weight 500 kgs., 120 blows per min., regulated or single blows, area of die block cap. 18¼in. by 15¼in., motorized 400/3/50.
Coborn Senior TOOL TIPPER, 48-kVA., 400/230V., will tip from ¼in. to 2in. sq. or equivalent of 4 sq. in., max. operation takes 4 mins.
TOLEDO Model No. 99 straight side, double crank geared PRESS, rated cap. 250 tons, 4in. stroke.
Bradley and Craven No. 7/26, Double-Sided Eccentric Geared PRESS, cap. 200 tons, 6in. stroke.
Stirk Double Housing, Rack-Driven PLANING M/C., type C.X., cap. 15ft. by 5ft. by 5ft., with table 17ft. by 4ft. 3in., running in "V" slides, length of bed 27ft., two vert. and two side toolboxes, swivel 45 deg. either side of zero, max. cutting speed 90ft. per min., Lancashire drive, input 400/3/50, output 215V. D.C.

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GRIMSTON B.G.7 DOUBLE-ENDED PEDESTAL GRINDERS, with two 7in. by ¾in. wheels and motorised for 220/1/50.
NEW VENTAIR TOTALLY ENCLOSED COMBINED POLISHING and DUST EXTRACTING MACHINES, to take 12in. dia. mops, 2800 r.p.m., self-contained motor drive for 400 volts, three-phase, 50 cycles, from motor mounted in base.
NEW WRIGHT 12in. TABLE SURFACE GRINDER, table working surface 28in. by 12in drive by 3 H.P., 400/440/3/50 motor.
NEW N.1, 14in. D.E. PEDESTAL GRINDER, with two 14in. by 2in. wheels, two-speed drive.
UNUSED ATLAS DOUBLE-ENDED ½ H.P. POLISHING SPINDLES for bench mounting speed 2800 r.p.m., 400/3/50.
HEALD INTERNAL GRINDER, 9in. dia. four-jaw chuck, max. swing over table 10in.
SCRIVENER No. 1 CENTRELESS GRINDER, cap. ¾in. solid work, 1¼in. hollow work, grinding wheel 10in. by 3in., control wheel 7in. by 3in. face.
NAXOS UNION Type CM8 4000 ROLL GRINDING MACHINE, cap. 8ft. 6in. by 31in. dia., motorised 400/440/3/50 supply.
SEEST CENTRELESS CRANKSHAFT GRINDER, max. swing 18in., max. length of crankshaft to be ground 4ft.

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160-tube Green's Vertical Economiser, insurable for 180 lb. working pressure, tubes 9ft. 6in. long, complete with tube scraper gear, valves, gauges, &c

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ONE "WARD" No. 7 Capstan Lathe, plain bearing, single pulley drive, all-geared head, complete with bar equipment and ball automatic chuck.
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SOAG
LATE TYPE
MACHINE TOOLS
FOR PROMPT DELIVERY

BRADFORD 7in. S.S. and S.C. Lathe, A.G.H., motor drive, metric leadscrew, swing over bed 14¼in., swing over saddle 9¼in., between centres 30in., speed range up to 400 r.p.m.
HENDEY 8¼in. S.S. and S.C. Lathe, A.G.H., motor drive, metric leadscrew, taper turning, swing over bed 16¼in., swing over cross slide 9¼in., between centres 54in., speed range up to 635 r.p.m.
GOULD and EBERHARDT Model 8H Gear Hobber, for spurs, splines, sprockets and worm wheels, motor drive, max. dia. cut 6in., face cap. spurs 12in., max. hob dia. 5¼in., D.P. in steel 4.
SUNDERLAND Type 5A Gear Planer, motor drive, max. dia. spur gear 12in., max. gear width 4in., D.P. 5.
FELLOWS No. 61 Gear Shaper, motor drive, for spur gears, max. dia. gear ext. 35in., int. 25in., max. width ext. 5in., int. 3in., D.P. 4.
HEIDENREICH and HARBECK Model 75KH Gear Generator, motor drive, max. pitch dia. 29½in., max. length driving cone 16in., max. pitch module 20, largest face of tooth 6¼in.
WANDERER 51P Single-spindle Production Miller, motor drive, table 40½ by 12in., longt. trav. 29½in., vert. adj. of spindle head 10in., min. spindle to table 12¼in., speed range up to 600 r.p.m.
PARKSON 2T Universal Mill, motor drive, universal vertical swivel head, table 49in. by 10in., longt. trav. 28in., cross trav. 10in., centre of spindle to table 18¼in., speed range up to 360 r.p.m.
MASERATI Universal Miller, motor drive, vertical milling head, universal div. head, table 55in. by 13in., capacity 35¼in. by 10¼in. by 16¼in., speed range up to 675 r.p.m.
MUELLER MONTAG Type 4F Vertical Miller, flanged motor drive, sliding spindle head, table 47¼in. by 11¼in., capacity 28½ by 12⅝ by 17¼in., speed range up to 950 r.p.m.
WICKMAN 10mm. Single-spindle Automatic, motor drive, Swiss type, max. capacity for steel 10mm., max. capacity for brass 12mm., max. turning length 4in., speed range up to 8967 r.p.m.
FOSTER No. 5 Capstan, motor drive, chuck work with 3-jaw chuck, spindle bore 2in., swing over bed 16in., spindle nose to turret 29½in., speed range up to 405 r.p.m.
CINCINNATI ACME Model 5W Turret Lathe, motor drive, bar feed collet chuck, spin. bore 2¼in., height of centres 10¼in., spindle to turret face 29½in., speed range up to 600 r.p.m.
CHURCHILL Cylindrical Grinder, Model CY, motor drive, swing over table 10¼in., grinding length 36in., max. dia. ground 10in., grinding spindle speed 980 r.p.m.
PFAUTER Model FSA1 Hob Sharpener, motor drive, fully automatic, dust exhaust, max. dia. ground 6 5/16in., between centres 16¼in., table travel 13 3/16in.
STIRK "Hiloplane" Double-Column Planing Machine, Stirk patent electric drive, four toolheads, tandem tables, arranged for cross planing, capacity 24ft. by 7ft. 3in. by 5ft.
CINCINNATI-GRAY Widened Pattern Planing Machine, double column type, power rise and fall cross rail, four toolheads, power feeds, capacity 16ft. by 5ft. 2in. by 4ft. 8in.
BUTLER 10in. Puncher Slotter, motor drive, max. stroke 10in., rotary table dia. 33in., longt. traverse 30in., cross traverse 12in., ram speeds up to 33 per min.
HELLER Model 883H Hydraulic Cold Saw, motor drive, hand-op. and automatic roller stock feed, max. saw blade 38in., cutting capacity, rounds 13¾in., squares 12¼in., joists 24 by 11in., cutting speeds (inf. vari.) 26–95 f.p.m.
HELLER Model 88H.1600 Hydraulic Cold Saw, motor drive, chip remover, max. saw blade 63in., cutting capacity, rounds 26¼in., squares 21¼in., joists 39 by 20in., cutting speeds (inf. vari.) 29–88 f.p.m.

Inspection invited.

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ELECTRIC MOTORS, STANDARD A.C. SUPPLY

140 H.P. Laurence Scott Slip Ring, 980/675 r.p.m., screen portc., ball/roller bearings with starter, &c.
75 H.P. Wright and Wood S.C., 950 r.p.m., enc. vent.
50 H.P. Brook Slip Ring, 750 r.p.m., enc. vent., ball bearings, starter, &c.
48 H.P. L.D.M. "Maxtorq," 725 r.p.m., enc. vent., ball bearing, O.I. star/delta starter.
Two 30 H.P. L.D.M. S.C., 970 r.p.m., ball bearing.
25 H.P. Crompton-Parkinson Slip Ring, 1150 r.p.m., ball bearing.
Many others, smaller power.

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O.E.T. CRANE

One 2-Ton O.E.T. Crane, by "Smith," span 31ft. 6in., three-motor crane, motorised 400/3/50, floor or cab controlled.

COX & DANKS Ltd.,
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FOR SALE

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TURBO-ALTERNATOR SETS

(1) 3000kW. B.T.H. Turbo-Alternator set, new 1918, working pressure 175/200 lb., superheat temperature 550 deg. F., 3000 r.p.m., B.T.H. alternator, output 3300 volts, three-phase, 50 cycles, with switchgear, surface condenser, circulating and condensate pumps, valves, gauges, piping, &c.
(2) 1500kW. Turbo-Alternator, by Metropolitan-Vickers Electrical Co., Ltd., consisting of a turbine-cum-condenser designed to work at a steam pressure of 200 lb. per sq. inch, superheat 600 deg. F., and to pass out up to a maximum of 25,000 lb. of steam per hour at a pressure of 30 lb. per sq. inch. The turbine is coupled through a single reduction gear to an alternator wound for 3300 volts, three-phase, 50 periods, with switchgear. The set is complete with exciter, circulating pump, and all fittings and mountings. The set is of the latest turbo bloc type with the turbine, condenser, alternator all on floor level, thereby doing away with the cost of expensive foundations. The whole set is in first-class condition. Particulars and price with drawings, on application.
(3) 1000kW. Belliss and Morcom/Lancashire Dynamo Turbo-Alternator Set, new 1923, working pressure 140 lb. p.s.i., temperature 500 deg. F., 3000 r.p.m., alternator output 7000 volts, three-phase, 50 cycles, with automatic voltage regulator and switchboard, Belliss and Morcom surface condenser, circulating air and condensate pump, valves, gauges, piping, &c.
(4) 1000kW. Belliss and Morcom/Lancashire Dynamo Turbo-Alternator Set, new 1924, working pressure 140 lb. p.s.i., temperature 500 deg. F., 3000 r.p.m., alternator output 7000 volts, three-phase, 50 cycles, switchboard, Belliss and Morcom surface condenser, circulating air and condensate pumps, valves, gauges, piping, &c.
(5) 1000kW. Belliss and Morcom/Lancashire Dynamo Turbo-Alternator Set, new 1925, working pressure 140 lb. p.s.i., 3000 r.p.m., alternator output 3300 volts, three-phase, 50 cycles, switchboard, complete with jet condenser, motor-driven circulating pumps, valves, gauges, piping, &c.
(6) 650kW. Westinghouse Turbo-Alternator set, new 1915, working pressure 140 lb. p.s.i., 3000 r.p.m., alternator output 3300 volts, three-phase, 50 cycles, switchboard, jet condenser with motor-driven circulating pump.

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600
TURBINE PUMPS

Two-stage Turbine Pump by GWYNNE, casing type, 10in. suction, 9in. delivery, 1750 g.p.m., 308ft. head at efficiency of 80 per cent., absorbing 202-h.p. at 1500 r.p.m., direct coupled 225-h.p. slip-ring Harland motor, 400/3/50.
Four Multi-Stage Turbine Pumps by MATHER & PLATT, 3in. suction, 2in. delivery, Pluvius type, 100 g.p.m., 650ft. head, 2930 r.p.m.
Four Multi-Stage Turbine Pumps by MATHER & PLATT, 2½in. suction, 1in. delivery, 12-stage type, cap. 85 g.p.m., 1670ft. head at 2930 r.p.m.
Horiz., 8-stage Turbine Pump by LEE HOWARD, size 4/5, split casing type 4507, 300 g.p.m., 950ft. hd. at 1410 r.p.m., 5in. suction, 4in. delivery.
Steam Turbine-driven Pump, by HOLDEN & BROOK, 5in. suction, 4in. delivery, capacity 1200 g.p.m., 230ft. hd., direct coupled steam-driven turbine by Mirrlees Watson.
Horiz., 6-stage Turbine Pump by MATHER & PLATT, 200 g.p.m., 345ft. hd., 1460 r.p.m., direct coupled 40-h.p. S.C. motor, 400/3/50.
Horiz., 2-stage Turbine Pump by SULZER, 1000 g.p.m., 300ft. hd. at 2250 r.p.m., "V" belt driven from 84-h.p. Crossley diesel engine, type BV8.
Horiz., 4-stage GWYNNE Pump, 4000 g.p.m., 300ft. hd., "V" belt driven by 20-h.p. Fodens diesel engine, 1000 r.p.m.
Six-stage horiz. Turbine Pump by PULSOMETER, 300 g.p.m., 340ft. hd., 6in. horiz. suction, 4in. vert. delivery, "V" belt driven by 55-h.p. Brush motor, 400/3/50, speed 1450 r.p.m.

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PROGRESS 4E Pillar Drill, No. 4 M.T., 400/3/50.
ARCHDALE 4-Sp. Drill, No. 2 M.T., 400/3/50.
BUTTERWORTH 1 1/16in. S. Sp. Auto., 400/3/50.
SNOW V.B. Vert. 8p. Surface Grinder, long feeds, 415/3/50.
CHURCHILL 10in. by 24in. Univ. Grinder, 400/3/50.
WILSON 8in. by 42in. Gap Bed Lathe, with 26in., 400/3/50.
HERBERT No. 1 Horiz. Miller, W/8 16in. by 6¼in., 400/3/50.

NORMAN E. POTTS (B'HAM), LTD.
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(VIC 1278). E9405

Further lists of machines on page 113.

NEW 8½IN. CENTRE LATHES FROM STOCK

An Invitation : We cordially invite all interested to come to our works at Rotherham to view the modern appurtenances and precision of the up-to-date machine, actually operating in the workshop.

LOUIS DEMERY & SONS LIMITED,
42, STATION ROAD, ROTHERHAM.

For continuation of Small Advts., page 10

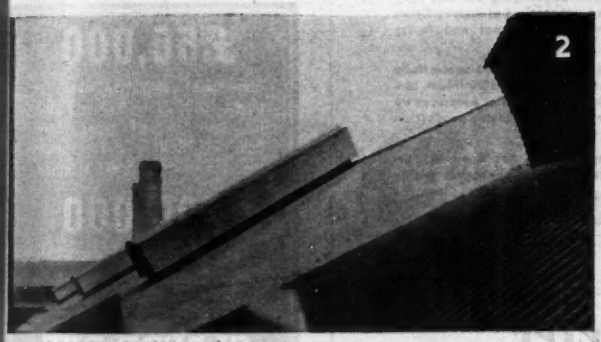
SEE COLT ABOUT VENTILATION — WHATEVER YOU DO

At the Appleby-Frodingham Steel Co. Ltd.,

VENTILATION BY

COLT

1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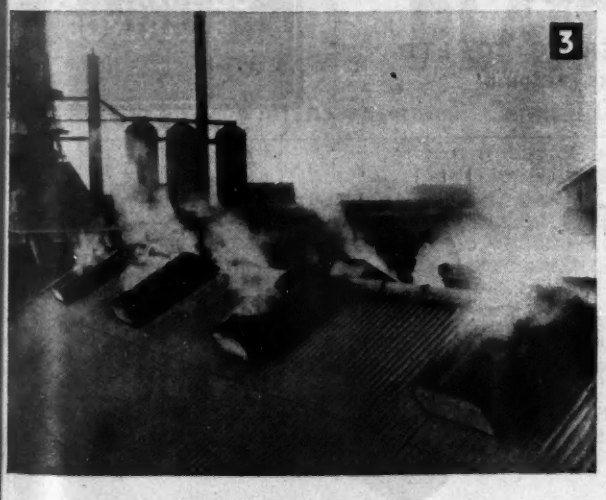
3

Many years' experience of all types of ventilation problems enables us to bring a supremely practical approach to the science of air induction and extraction. If your problem is one of existing conditions which are unsatisfactory, then Colt can effect the greatest possible improvement — often without structural alteration or interrupting production. If you want maximum flexibility of ventilation in any new plans you may have in hand — we shall be glad to give our advice at the earliest possible stage. Our experts are always keen to tackle new problems or advise on more familiar ones.

At the Appleby-Frodingham Steel Works great improvements have been effected with ventilation by Colt. The large photograph, an internal view of the Main Sinter Plant, shows how the new ventilation quickly forces the steam and sinter dust to rise and be extracted without spreading (prior to the installation it was impossible to see across this shop). All Sinter Plants at these works have been improved in this remarkable way, and picture (2) shows the external view of some of the ventilators which are doing the job — in this case the Continuous S.R. type ventilator.

Picture (3) shows another ventilation scheme, above the Sinter Drying Plant, with the smaller size S.R./3080 ventilators. The high degree of extraction can easily be seen.

FREE MANUAL *with full specifications of the types of standard Colt Ventilators is available on request from Dept. G.10/187*

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G.10

B

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SPECIALISTS in FABRICATION of Industrial Plant

in Mild Steel, Stainless Steel and Monel-Metal

PLATE BENDING and ROLLING - 8ft. x 1in. thick

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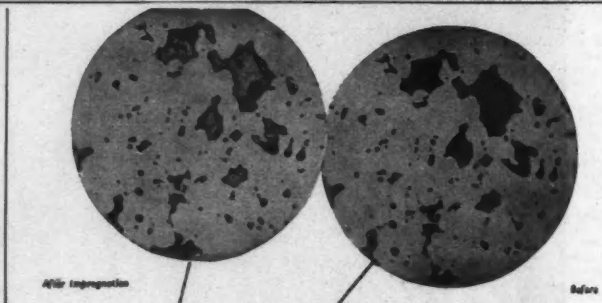

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The Pulsometer Engineering Co. Ltd. have developed a vacuum method of impregnation which efficiently seals porous and faulty castings.

This process has been applied successfully to bronze, gunmetal, steel, aluminium and cast iron castings of all sizes at pressures up to 1,200 lb. per sq. in., thus saving production time, money, and labour.

Vacuum Impregnation has been so perfected that castings can be sealed within 48 hours.

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Immediate cash available for purchase of New Ball and Roller Bearings, all types, Steel Balls and Rollers. Top prices Paid, small quantities accepted.

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NEW BALL RACES, ROLLER, THRUST AND TIMKEN RACES in stock.

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ROTARY VALVELESS SELF-PRIMING POSITIVE DELIVERY PLUNGER PUMPS UP TO 4500 G.P.H.

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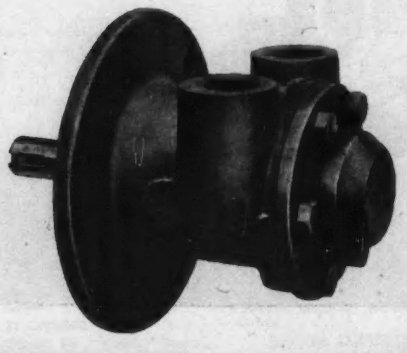

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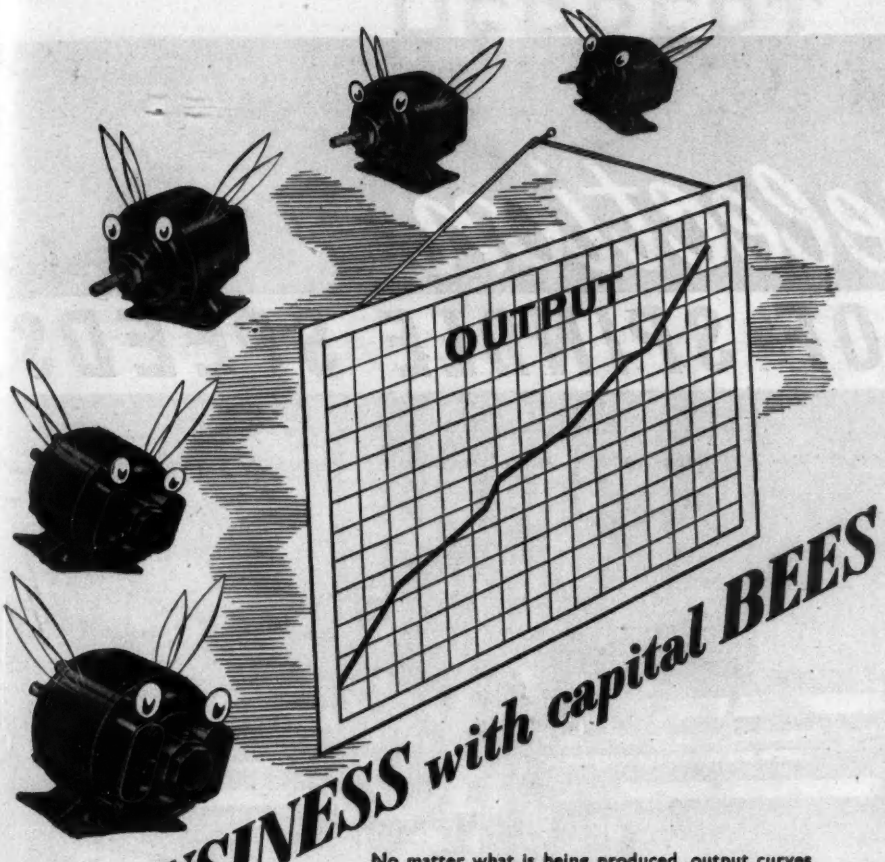

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All jobs come alike to these " skilled workers "—reliability is their strong point—" BEE of Service " is their motto.

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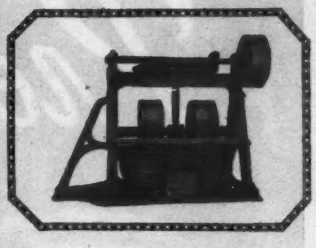

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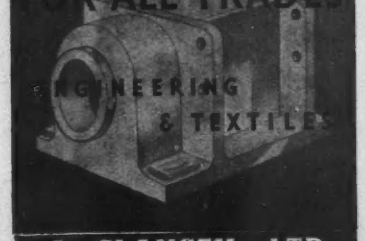

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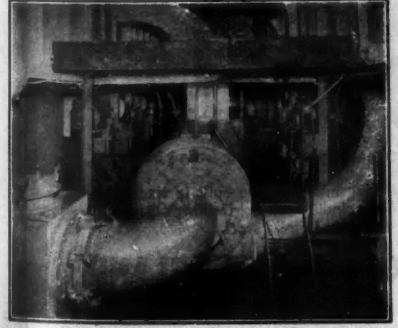

Main Machinery Room showing High Efficiency Pump in foreground, with quick release bean for rapid inspection of pump.

All Electric Reclamation Pumping Plant "Larubi." Constructed for the Anglo-Iranian Oil Co. Ltd. Dimensions : 74×22×7 feet. Pumping capacity : 200 tons of mud per hour through 500 feet of shore pipe to a height of 30 feet above low water.

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Preselection OF SPINDLE SPEEDS..

..ensures improved performance and lower costs at Sigmund Pumps Ltd. Gateshead.

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PRE – SELECT RADIAL DRILLS

The preselection of spindle speeds has meant improved performance and reduced costs on the drilling and tapping of cast steel multi-stage pump casings at Sigmund Pumps Ltd. Eight holes are drilled and tapped ¾ in. Whitworth in the flange, as shown. In the other side of the casing 40 holes are drilled and tapped, ranging from ¾ in. to 1 in. Whitworth.

Preselect radial drilling machines are built in sizes ranging from 4 ft. to 7 ft. spindle radius. Drilling capacity up to 3 in. dia. from the solid in mild steel.

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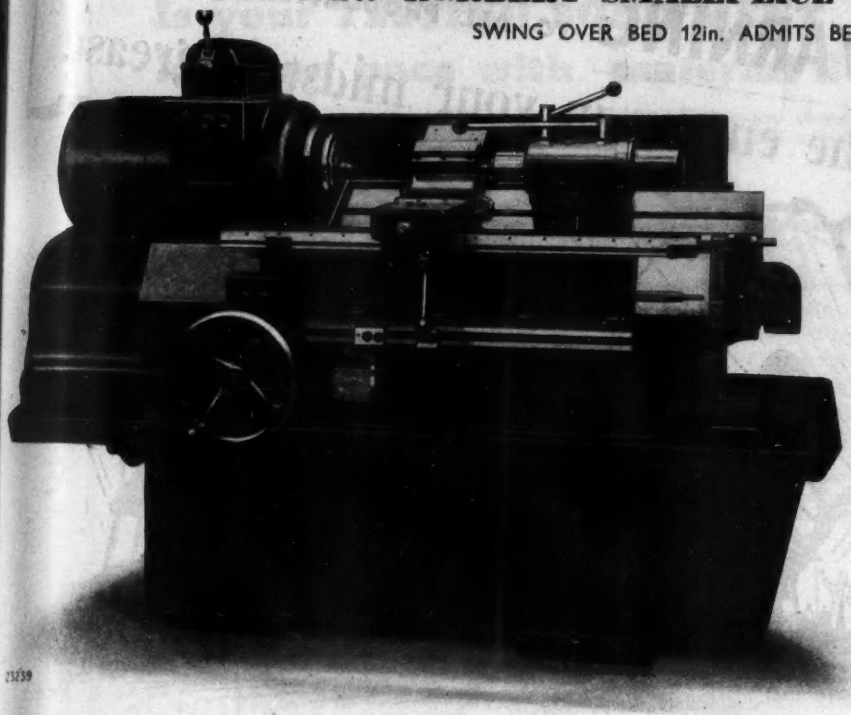
THE NEW HERBERT SMALLPEICE 6in. M. MULTI-CUT LATHE

SWING OVER BED 12in. ADMITS BETWEEN CENTRES 27in.



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For the fastest and most economical turning, facing, grooving, profiling and boring operations on bars, forging, stampings or castings.

Headstock is a three-speed motor; the headstock casting carries the stator, the rotor being mounted on the spindle. Lever-operated speed change.

Automatic cycle control; one push button controls all movements; starting and stopping the spindle, rapid traverse of tools to cutting position, feed and return to starting point.

PROMPT DELIVERY

Full particulars from:—
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INTERNATIONAL MACHINE TOOL EXHIBITION
Olympia, Sept. 17th—Oct. 4th, 1952
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Stand No. 66A, Grand Hall
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HIGH PRESSURE RAM PUMPS TO SUIT ALL REQUIREMENTS

The Pump illustrated is suitable for handling a corrosive paste. All pumping parts are made from stainless steel. Stepless control of the pumped delivery between full output and 35% output is available by regulating the speed of the A.C. commutator motor.

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Main Propelling Diesel Engines in powers up to

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HIGH QUALITY ENGINEERING AND MACHINE TOOL, HEAT AND WEAR RESISTING UP TO 5 TONS

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WE MAKE
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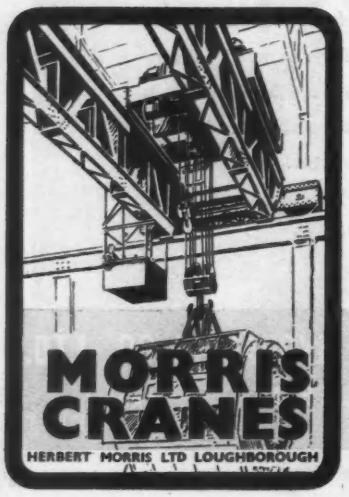

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WARNING TO ALL PRODUCTION MANAGERS

The enemy in your midst is grease

Surfaces collect many types of greasy deposits during the course of manufacture. Some are very stubborn and difficult to remove by normal degreasing methods. That is where the B. H. Chemicals' Technical Representative and Laboratory Services come in. A reversed-charge telephone call to LIBerty 1021 will bring skilled advice and their Laboratories will specify a grade of degreasant which will do the job—and avoid rejects.

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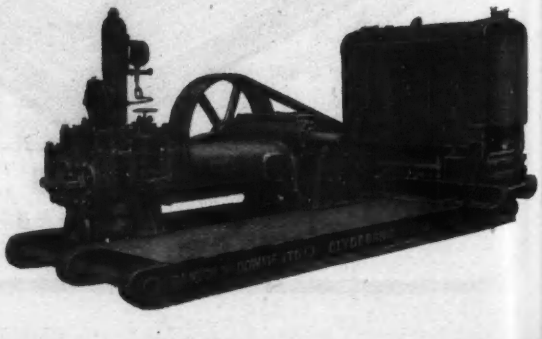
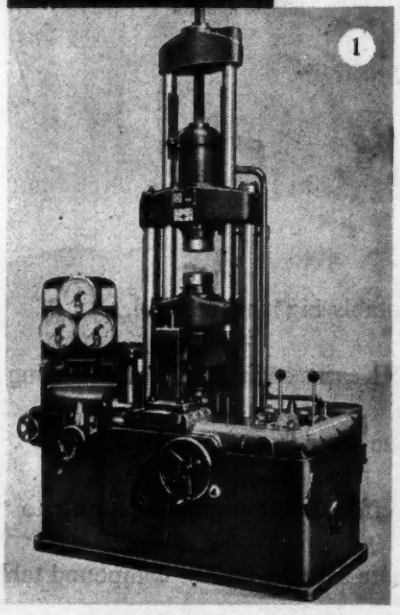


Telegrams: Pumps, Clydebank
Telephone: Clydebank 2271/2/3.

Is your TESTING EQUIPMENT keeping pace with material development ?

The strength of materials under normal temperatures has to-day already been examined to a far reaching extent, but the behaviour of stressed materials at high and maximum temperatures is rapidly becoming the subject for a wider field of investigation.

LOSENHAUSENWERK of Dusseldorf have a long established reputation for the development of material testing equipment, and the machines shown here have been designed to meet many of the requirements of research workers and development engineers concerned with the manufacture and application of materials including the new heat-resisting alloys.



UNIVERSAL MATERIAL TESTING (1)

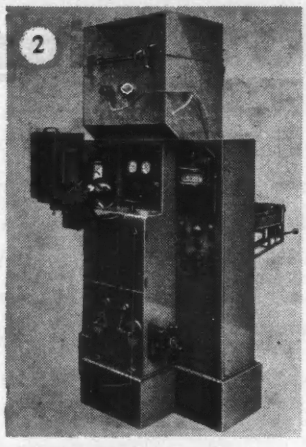
An outstanding feature of Losenhausenwerk machines for static and dynamic testing of materials is that actual components and complete assemblies can be tested under conditions as near as possible to those to which the parts are likely to be subjected while in use.

FOR STATIC TESTS

Tensile, compressive, collapsing, bending, folding, shearing and Brinell ball pressure hardness tests can be carried out on this equipment. There are machines for loads from 2,000 to 200,000 kg. The larger types can be fitted with a Pulsator for dynamic tests with fluctuating loads in tension *or* compression.

FOR STATIC AND DYNAMIC TESTS

The fatigue life of a component as designed can be determined on these machines in addition to standard fatigue tests on the material.
Three types of fatigue tests can be carried out :—
(*a*) With fluctuating loads in tension.
(*b*) With fluctuating loads in compression.
(*c*) With alternating loads from tension to compression.
Available with dynamic capacities from 1,000 to 10,000 kg. The smaller machines may be fitted with furnaces for fatigue tests at *high temperatures.*

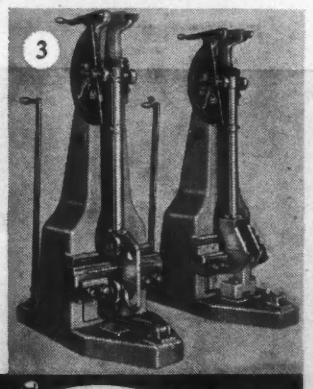


CREEP OR FATIGUE TESTING (2)

In addition to fatigue testing at high temperatures there is a range of Losenhausenwerk machines for examining the creep of various materials and alloys at *high temperatures* under constant load, constant elongation and variable elongation.
This plant is made in types for single piece tests or for testing up to 48 specimens simultaneously. Experiments can be carried out for the normal period of life characteristic of the part to be manufactured from the material under test. (For instance 10,000 hours or longer.) The attention given to this equipment need not exceed that of occasional supervision.

PENDULUM IMPACT TESTING (3)

Allied with the fatigue testing of material at low and high temperatures is the increasing demand for Impact tests following the Charpy method as distinct from, and in addition to, the Izod method which has long been standard in this country. The advantage of the Charpy method is the speed at which tests can be made so that temperature losses are reduced to a minimum.
Losenhausenwerk supply a range of Charpy type Impact Testers with striking energy 30, 75 or 250 mkg. The normal capacity 30 mkg. machine being capable, if required, of testing by both the Charpy and Izod methods.



GENERAL MATERIAL TESTING

Equipment is available for Brinell Hardness Tests ; Spring Testing, Vibration Testing, Chain and Cable Testing, Drop Testing, etc. Dynamic Balancing Machines, Vibration Tables and Measuring Boxes can also be supplied.

WICKMAN *of* COVENTRY

LONDON · BRISTOL · BIRMINGHAM · MANCHESTER
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Wickman

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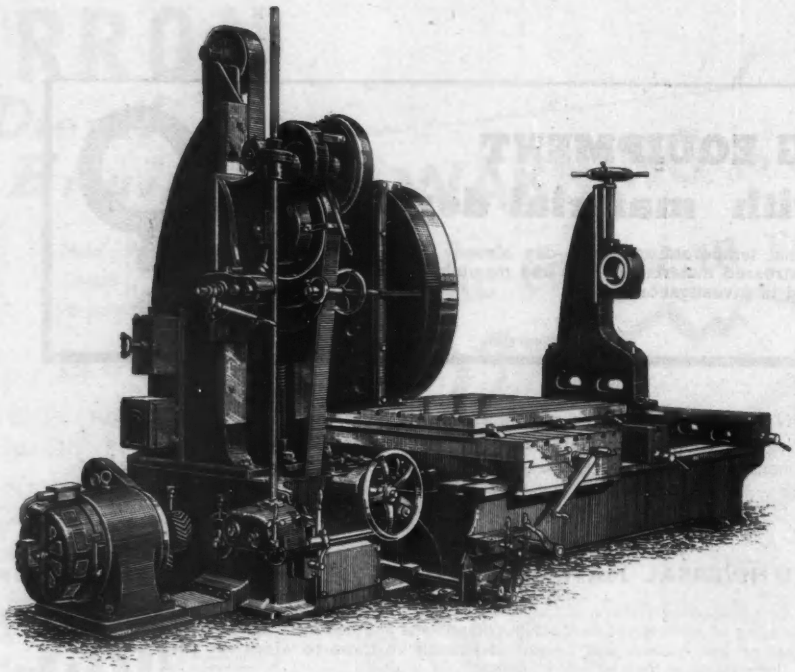


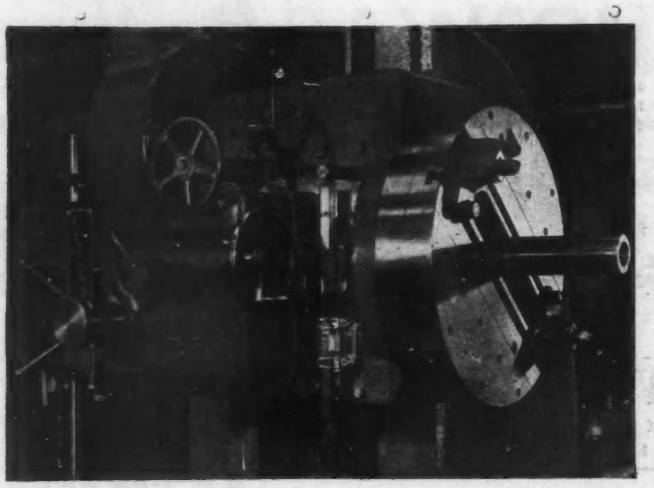
Circa 1915

The spindle slide, or vertical sliding head, looks weak to modern eyes when compared with the tables, but was suitable for contemporary cutting tools and methods.

KEARNS

biography of the borer

In its day a notably big machine tool, this Number 5 Kearns surfacing, boring, milling and drilling machine provides an interesting study in the further effort being made at that time to provide adequate support for the compound tables. The one-piece bed comprised, in effect, front and rear box-section castings to carry the saddle and the base for the boring stay.

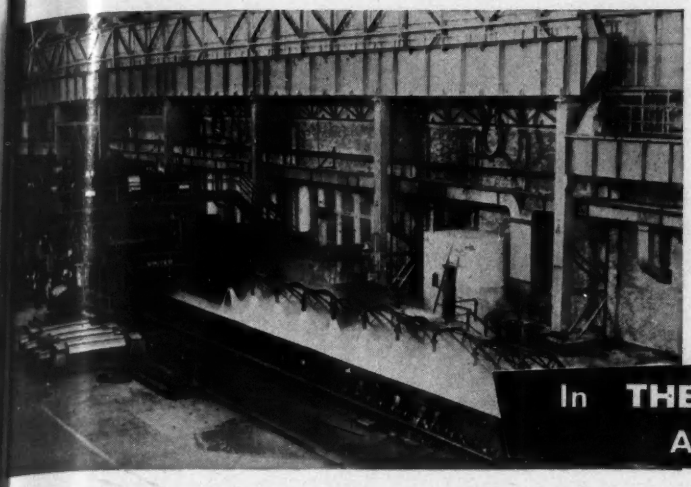


Kearns for Borers

Modern Kearns machines have all-round massiveness for using to full advantage the high rates of metal-removal common to-day with carbide tipped cutters.

H. W. KEARNS & CO. LIMITED, Broadheath near Manchester

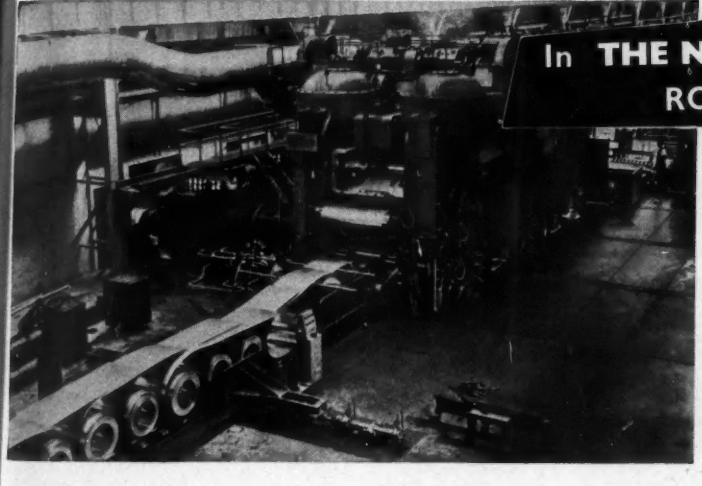
Hopwood



239 miles of electric cables were supplied and installed by BICC in the vast new Abbey and Margam Steel Works. Over seventy different types and sizes of cable were used, for every purpose from Power Distribution to Lighting and Communications. This is the largest industrial cabling contract ever placed in the United Kingdom with one manufacturer.

In **THE STEEL COMPANY** of **WALES'** ABBEY AND MARGAM WORKS

POWER CARRIED BY BICC CABLES



In **THE NORTHERN ALUMINIUM COMPANY'S** ROGERSTONE ROLLING MILL

Six substations are required to distribute the enormous quantities of electric power needed for this great new project at Rogerstone. Five of these are connected to the main switching station by a cable tunnel 640 yards long. The 8½ miles of 11,000 volt cable in this tunnel were supplied and installed by BICC . . . who also provided over 210 miles of various types of cable for low-voltage distribution systems.

Here are two examples of the kind of work at which BICC excel . . . highly specialised cable installations where the results of vast manufacturing resources and the teamwork of experienced engineers meet the exacting demands of large-scale industry. No cabling job is too big—or too small—for BICC; no destination too far to make deliveries, or too remote for our installation engineers. For we make every type of electric cable and install them anywhere.

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for all INDUSTRIAL CABLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE · NORFOLK STREET · LONDON, W.C.2

C

Oxidation prevented by 'FESCOL'-ising

In equipment subjected to heat, protection from oxidation and scaling can frequently be given by the Fescol Process of electro-deposition. Nickel is the material generally recommended and the process, being a cold one, does not damage the basis metal. One example of 'FESCOL'-ising in nickel is for the rollers in this large Plate Glass annealing Lehr which operates at 600° C.

Write for leaflet E3 which describes how the Fescol process protects machinery from the effects of oxidation, corrosion and wear.

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ESTABLISHED 1920

FESCOL LIMITED · NORTH ROAD · LONDON · N7 Branch Works: HUDDERSFIELD and PORT GLASGOW

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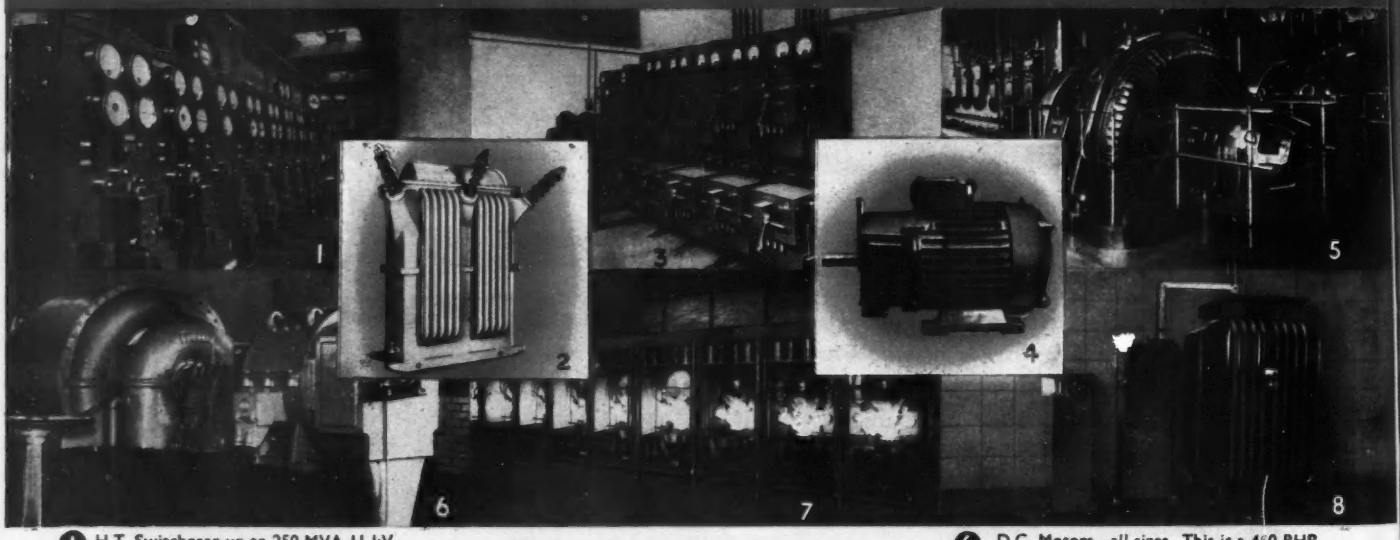
COMPLETE INDUSTRIAL ELECTRIFICATION



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2. Power Transformers up to 10,000 kVA and 33 kV
3. L.T. Switchgear—various types available up to 3000 amperes capacity.
4. A typical A.C. motor.
5. A large H.T. alternator with D.C. exciter (part of a diesel-engine set).
6. D.C. Motors—all sizes. This is a 460 BHP Variable Speed Motor in use at a gas works.
7. Mercury-arc Rectifiers. D.C. services from A.C. mains, including VARISPEED drives.
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WHETHER YOU NEED ONE MOTOR OR A COMPLETE FACTORY INSTALLATION, THE SERVICES OF OUR SPECIALIST ENGINEERS ARE AT YOUR DISPOSAL

Established 1882

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Head Office and Works: BUSHBURY ENGINEERING WORKS WOLVERHAMPTON

Telephone WOLVERHAMPTON 21455 (7 lines)

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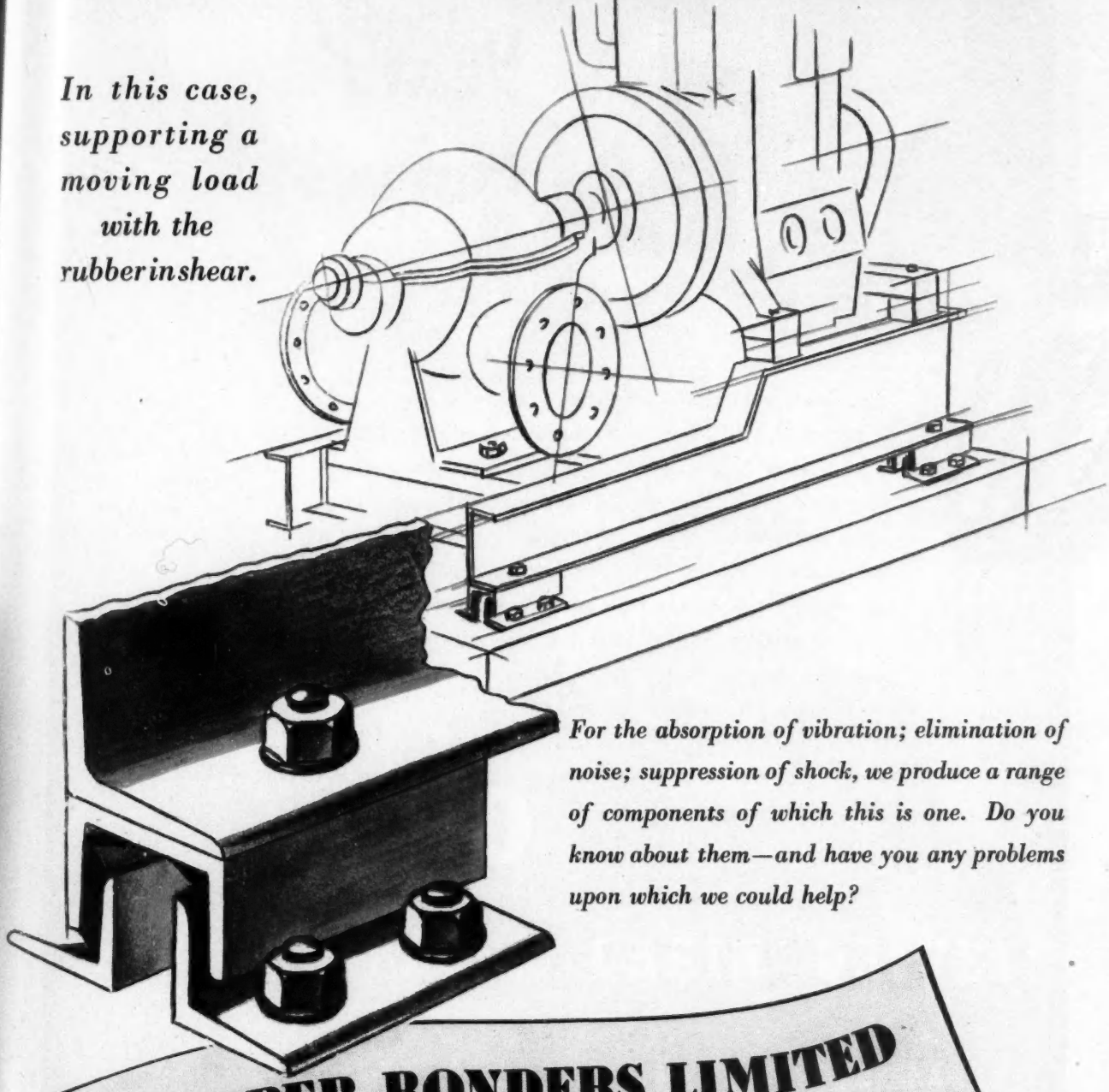
Manufacturers of Rotating Electrical Machinery, Switch and Control Gear, Rectifiers and Transformers

Showing the function of a

"FLEXILANT" **MOUNTING**

In this case, supporting a moving load with the rubber in shear.



For the absorption of vibration; elimination of noise; suppression of shock, we produce a range of components of which this is one. Do you know about them—and have you any problems upon which we could help?

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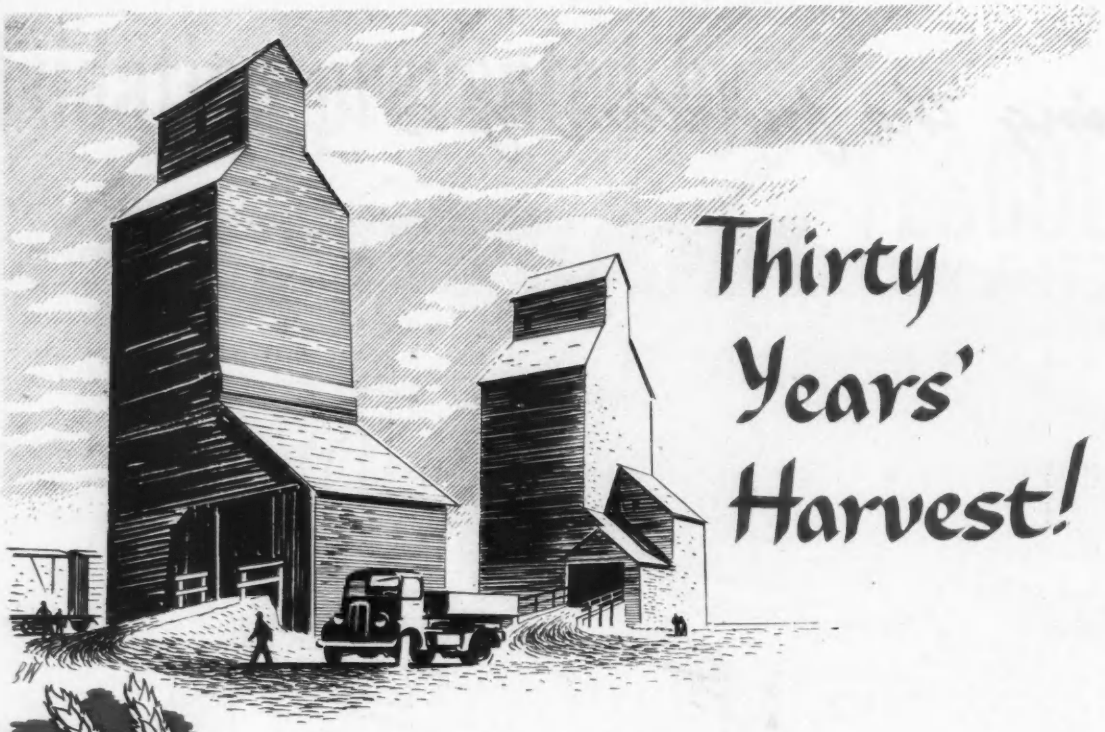
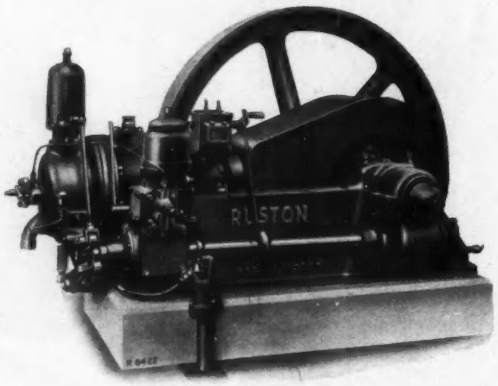


Thirty Years' Harvest!

Generally speaking, the adaptability of the oil engine makes it suitable for all kinds of driving duties, whether it's a medium or high speed vertical type or slower running horizontal unit. But, when a specialised application arises and a selected type of engine is found successful it becomes a 'standard.' This happened about 30 years ago when a few Ruston slow speed horizontal engines were applied for powering grain elevators in Canada. Since then, the same type of power unit has remained almost unchanged, certainly unchallenged, and thirty years' rich grain harvests have been reaped from the Prairie Provinces with the help of hundreds of Ruston Engines, unrivalled for just that dependable power which the grain elevators must have.



RUSTON oil engines

Vertical types from 3 to 2400 b.h.p. Horizontals from 5 to 295 b.h.p.

RUSTON & HORNSBY LTD · LINCOLN

Associated with Davey, Paxman & Co. Ltd · Colchester

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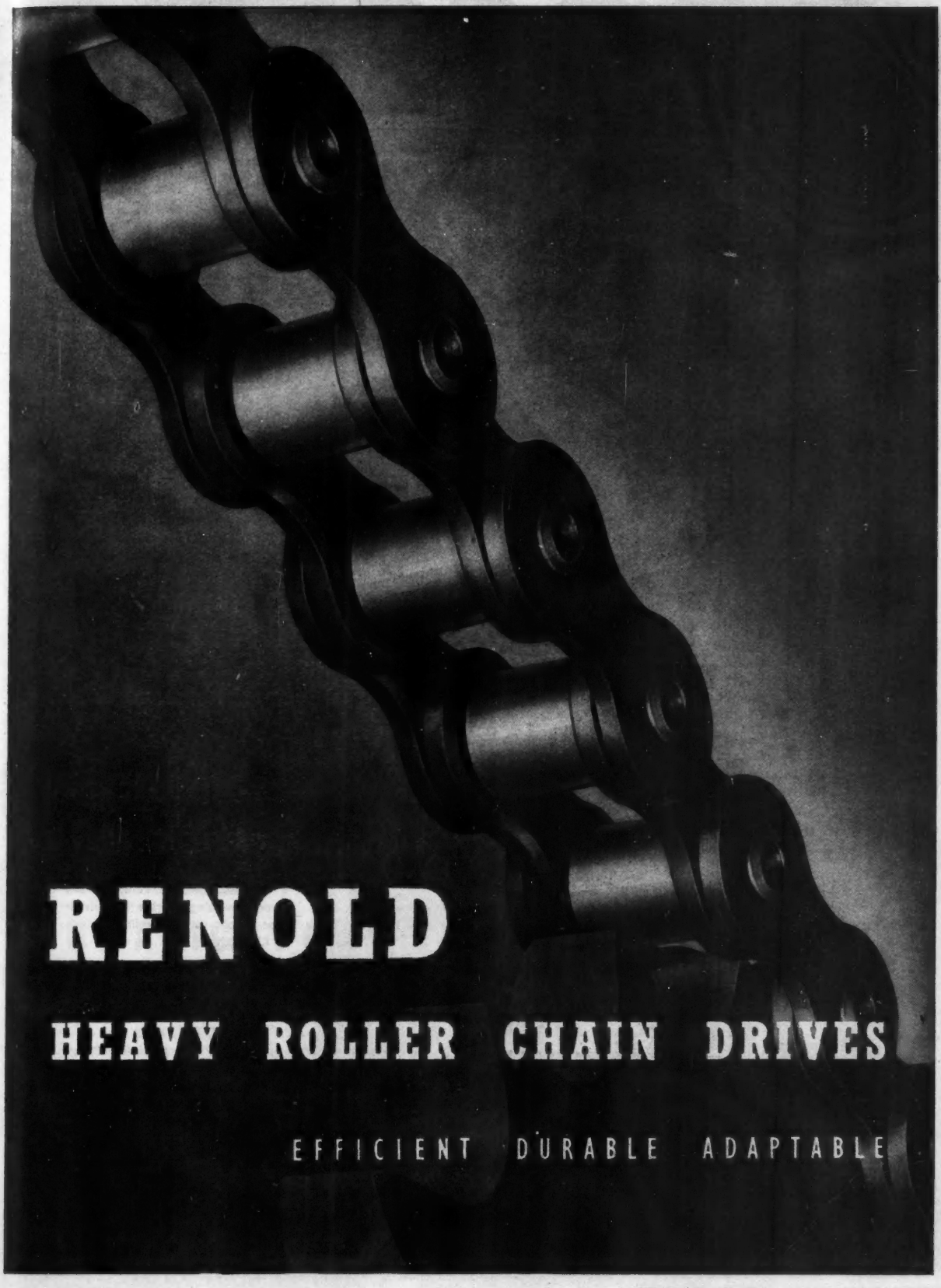

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THE RENOLD & COVENTRY CHAIN CO. LTD. MANCHESTER

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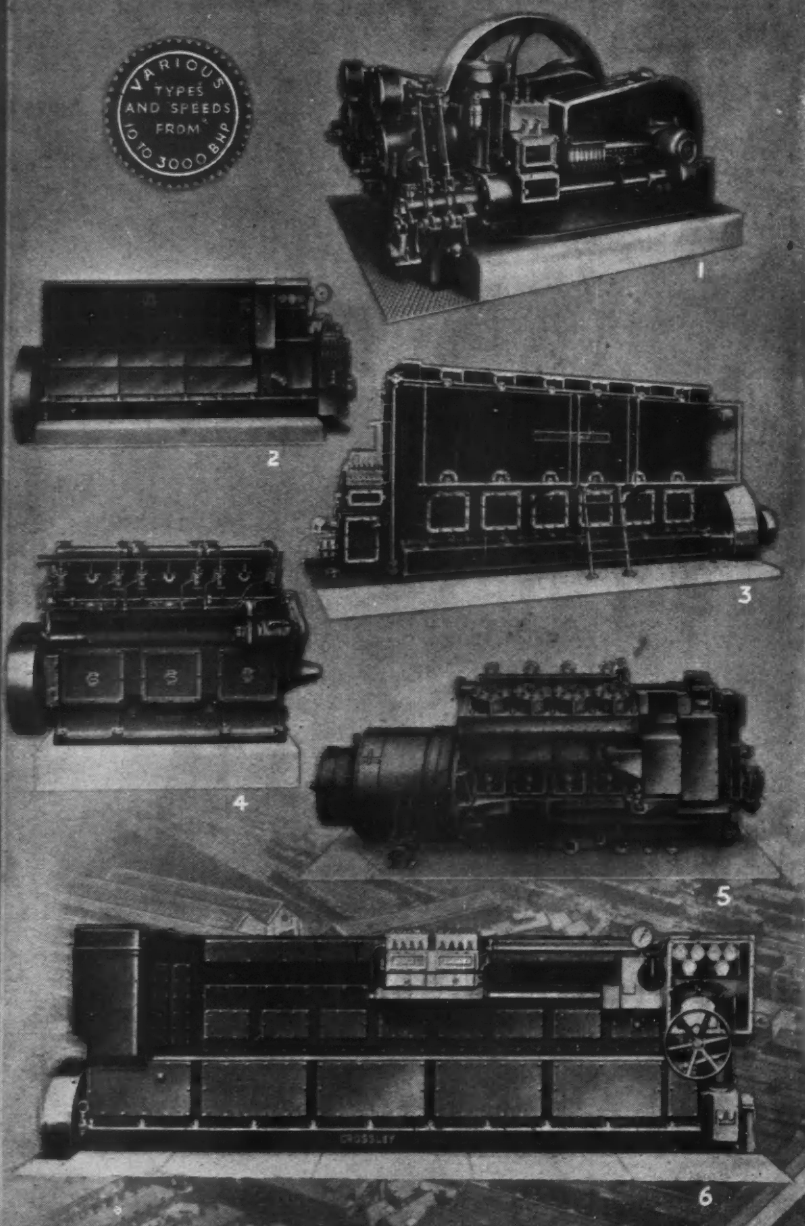
CROSSLEY

DIESEL ENGINES

INDUSTRIAL · ELECTRIC · MARINE · TRACTION



The Name **CROSSLEY** has been identified with internal combustion engines for over eighty years, as pioneers of the industry, and many thousands of engines have been built for despatch to all corners of the world.

The Illustrations

1 Horizontal, four-stroke industrial type Diesel. Single cylinder and twin monobloc types. 12 to 200 b.h.p.

2 Vertical, industrial type Scavenge Pump Diesel. Three to eight cylinders. 100 to 1,800 b.h.p.

3 Vertical, four-stroke industrial type Diesel. Three to eight cylinders. 150 to 1,065 b.h.p.

4 Vertical, four-cycle Diesels for industrial, marine propulsion, and rail traction duty. One to six cylinders. 10 to 140 b.h.p.

5 Vertical, Vee type Scavenge Pump Diesel and generator for rail traction duty. Six to sixteen cylinders. 440 to 2,400 b.h.p.

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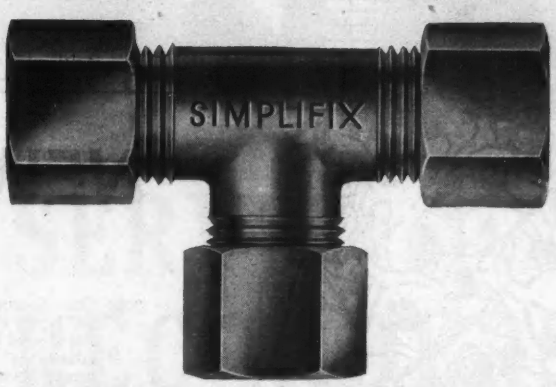

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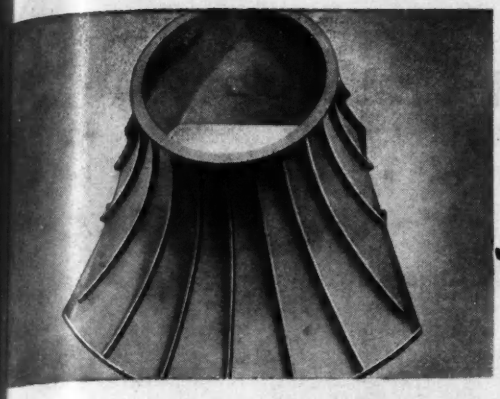

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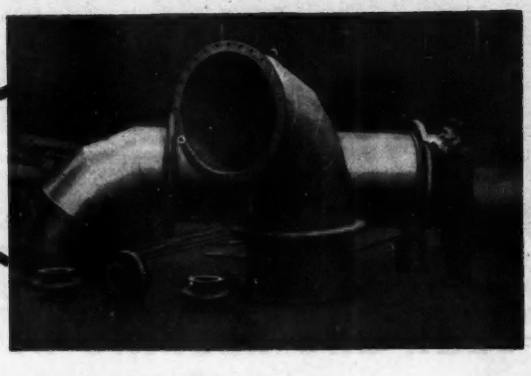

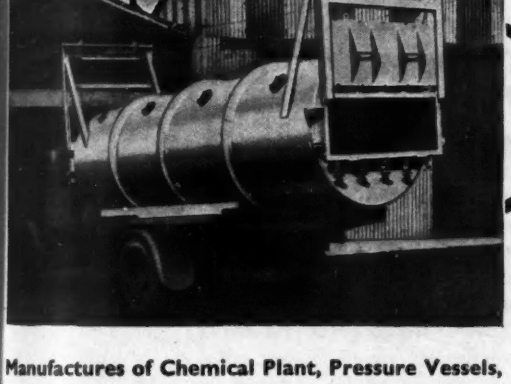

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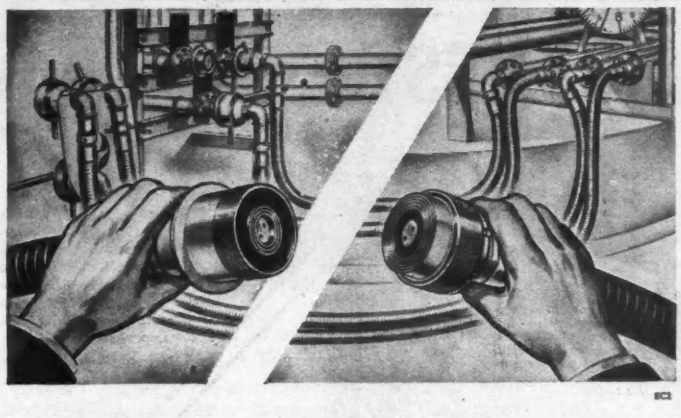

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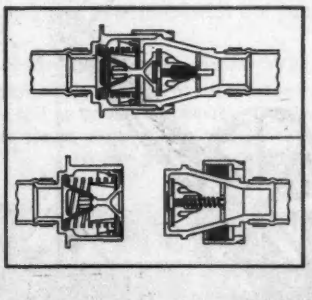

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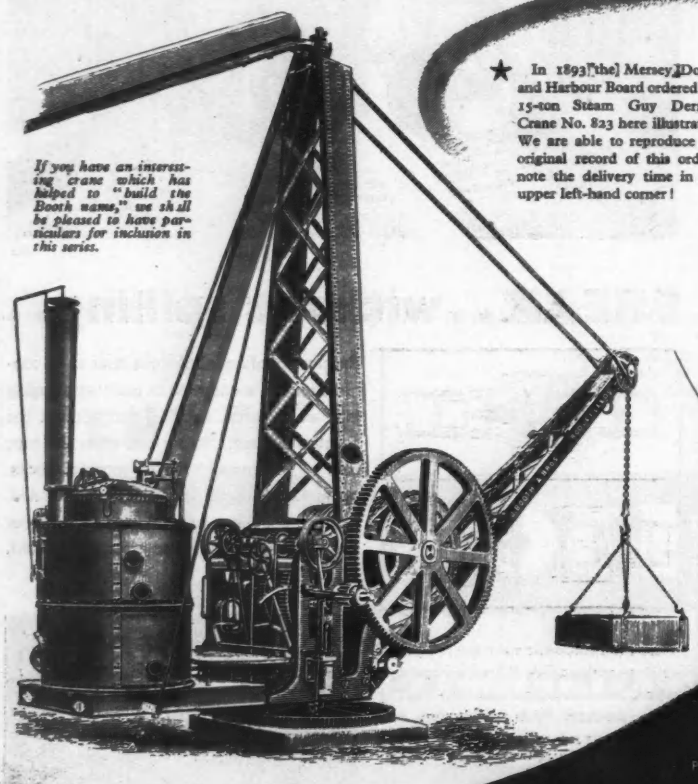

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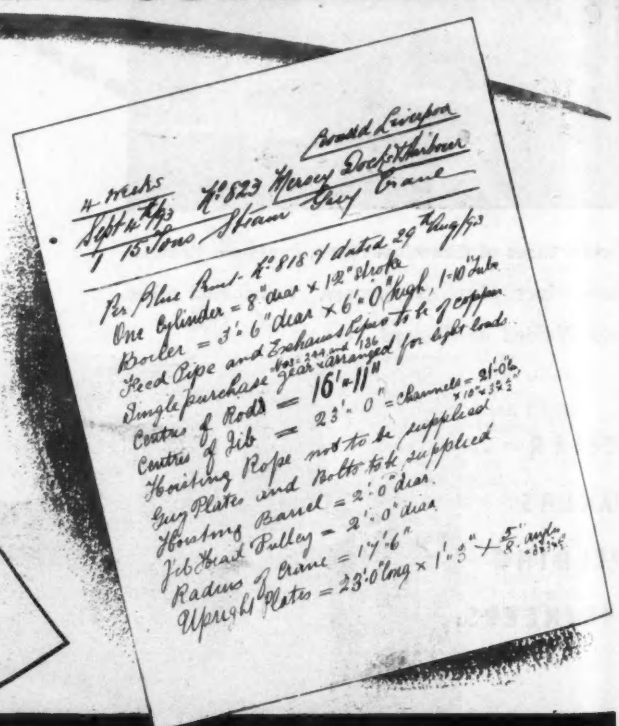
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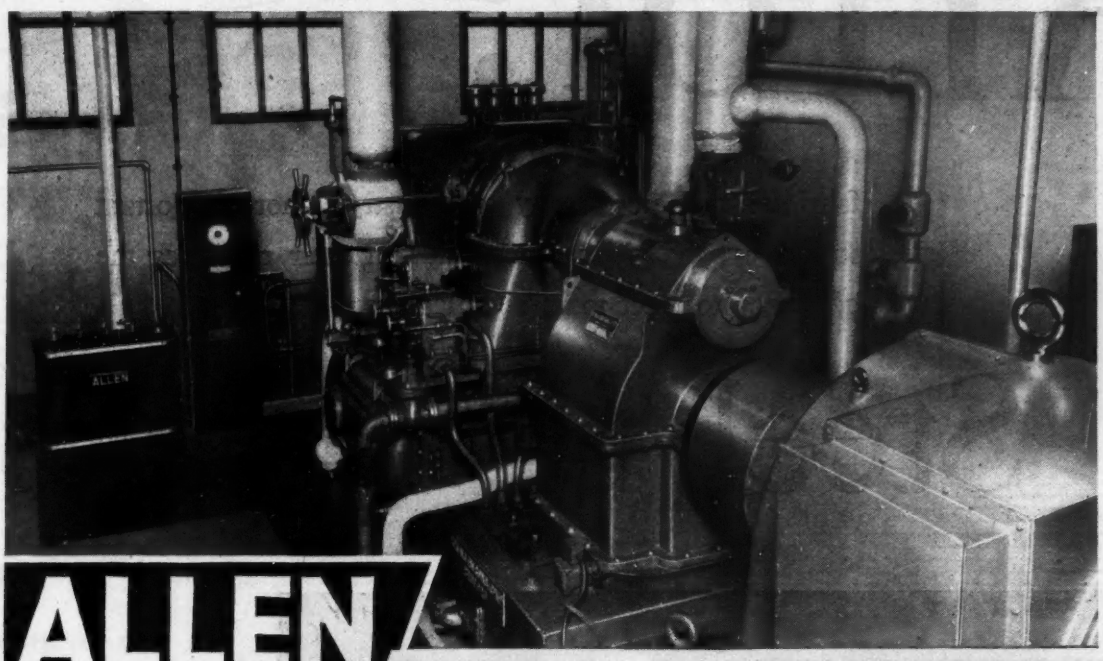

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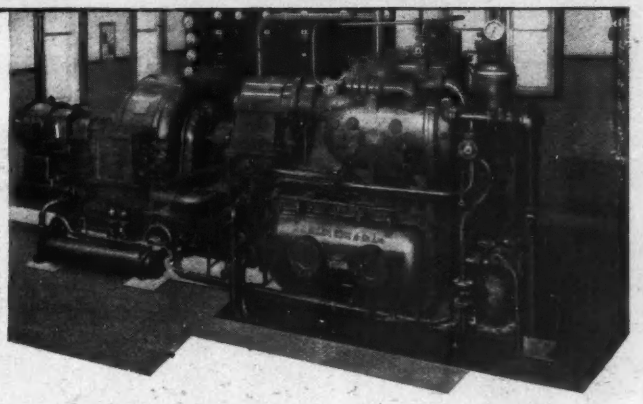
Illustrated are two typical Allen high-efficiency turbo-alternator installations in the Gas Industry.



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(Lower Illustration)

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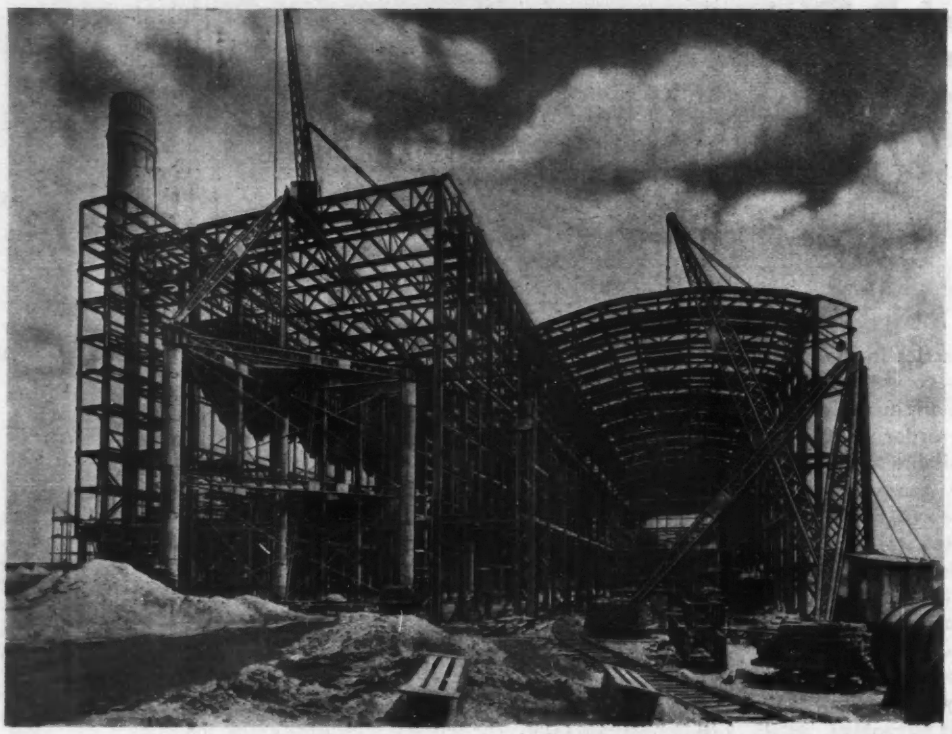

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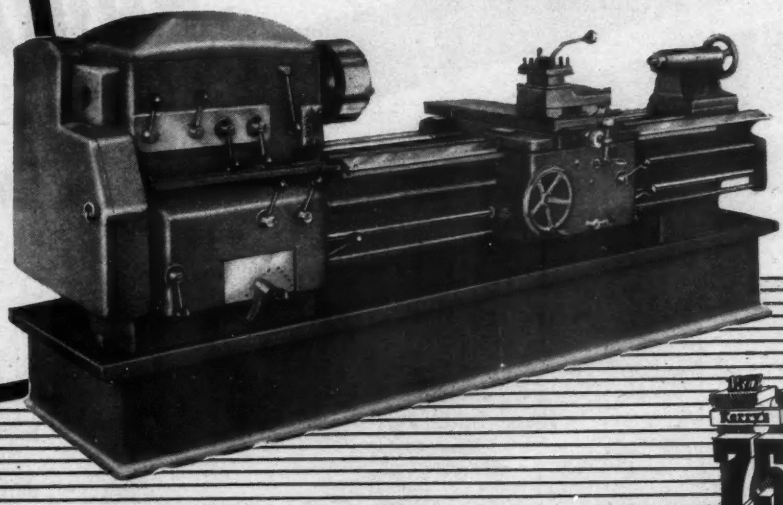

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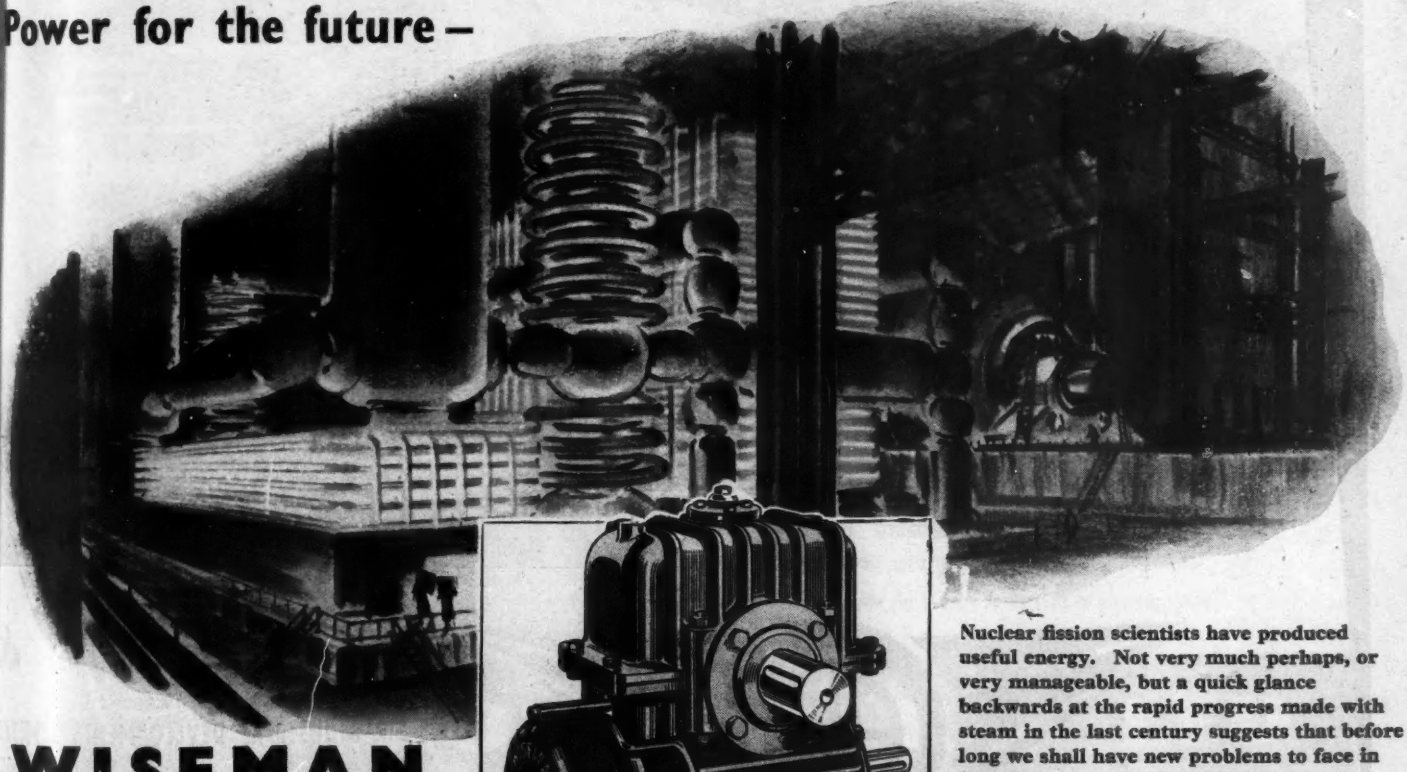

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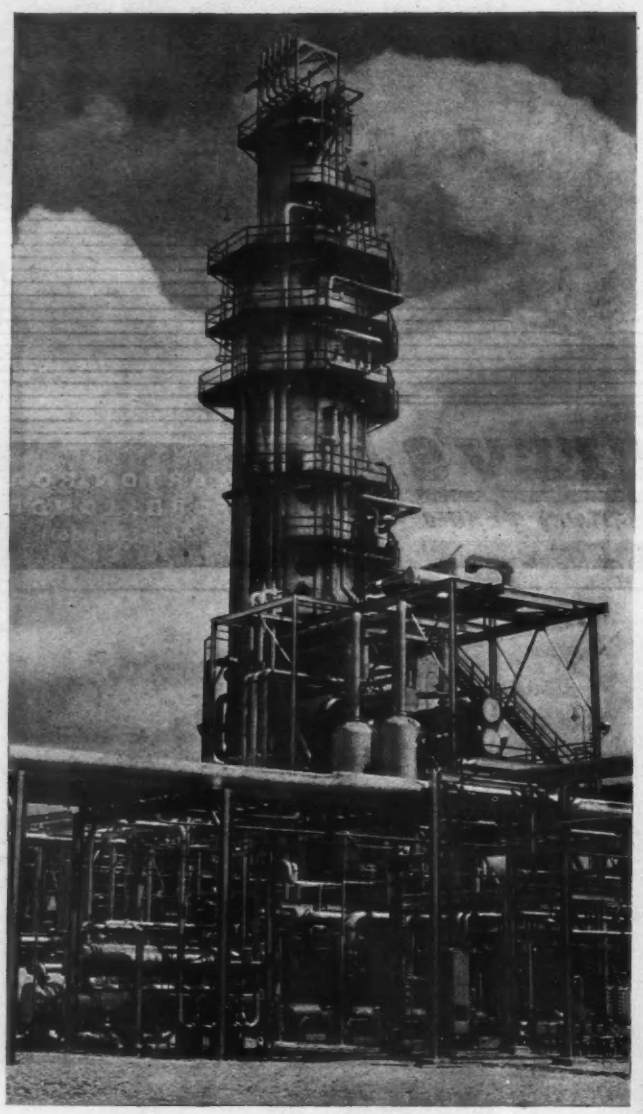

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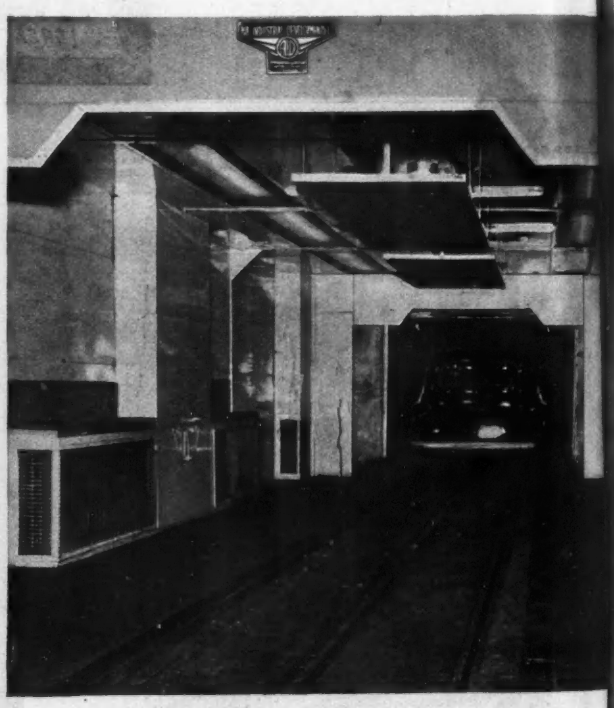

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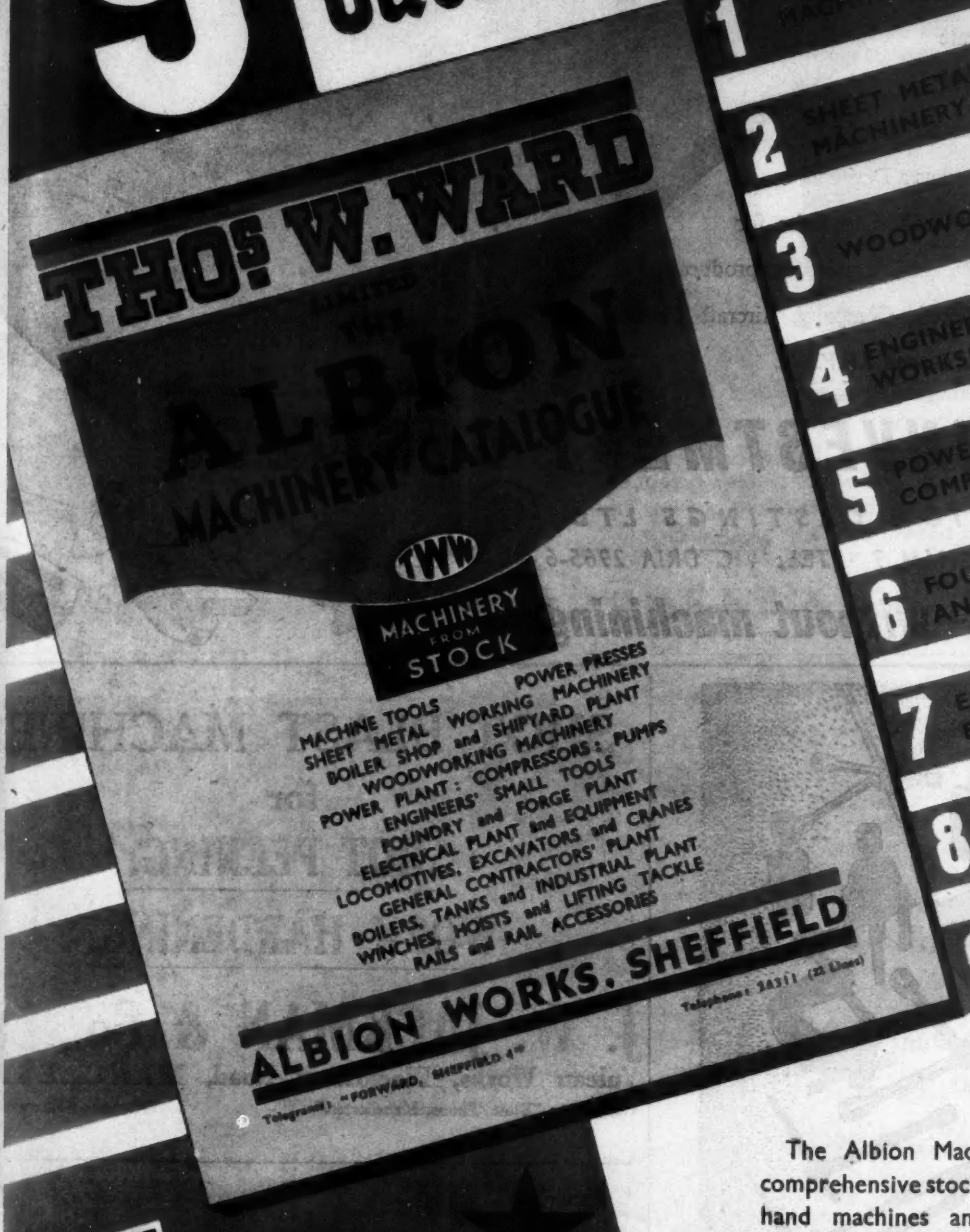

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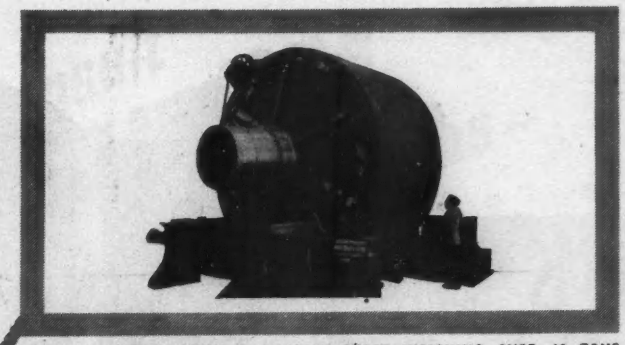

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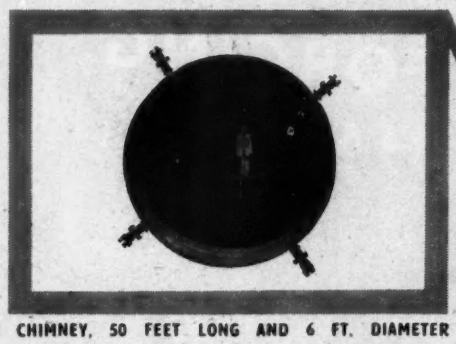

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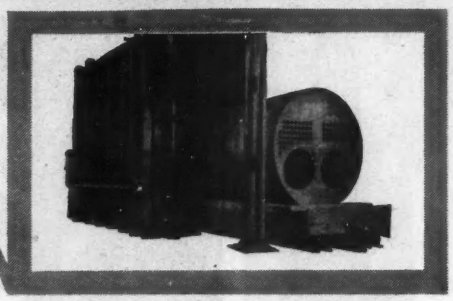

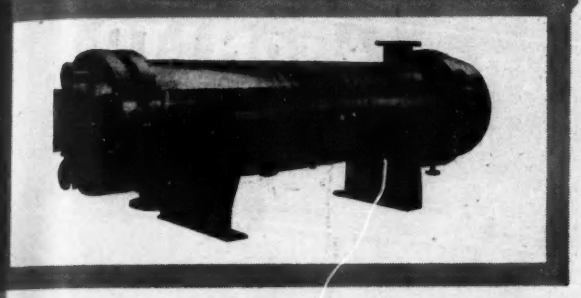

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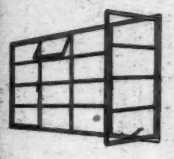

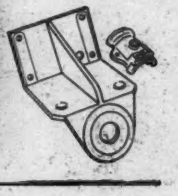

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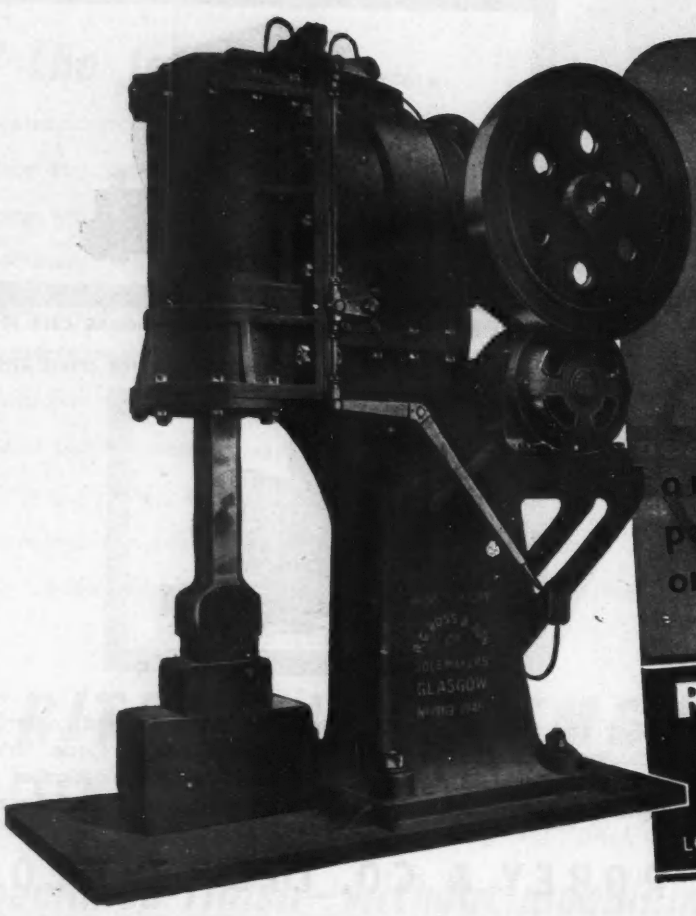

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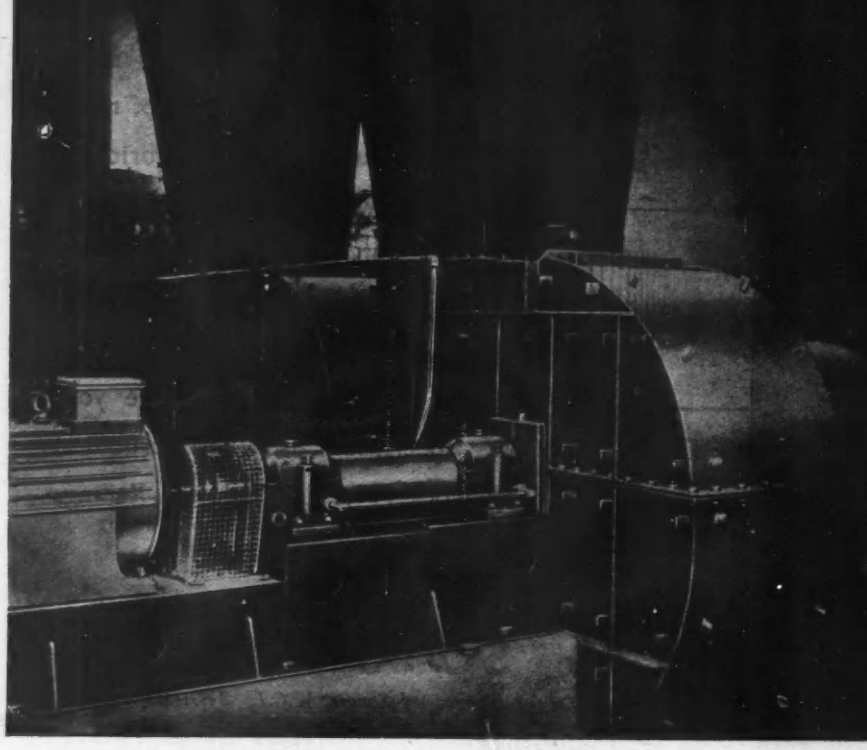

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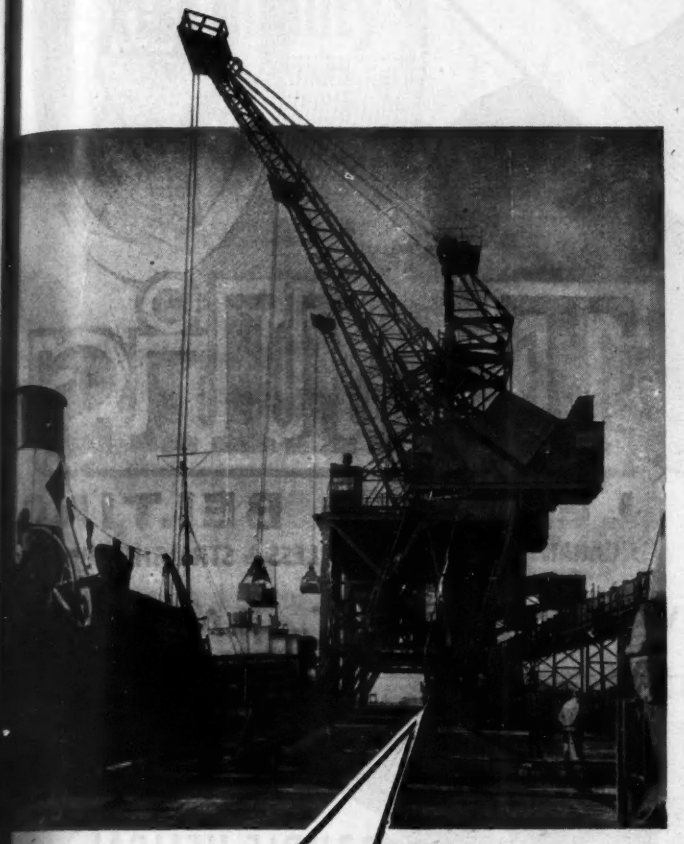

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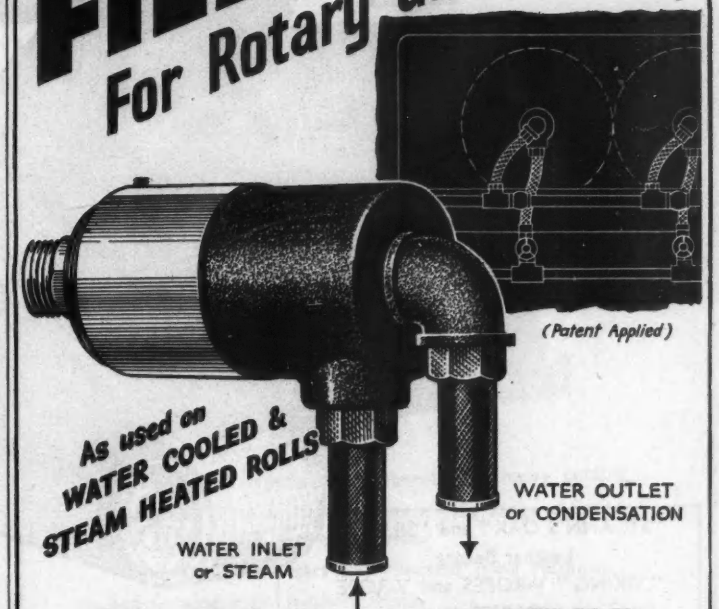

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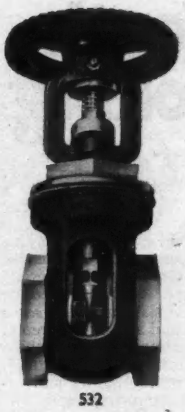

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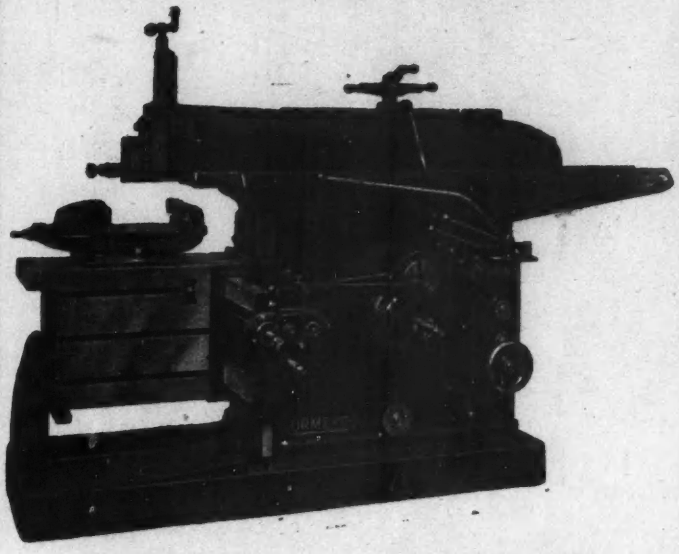

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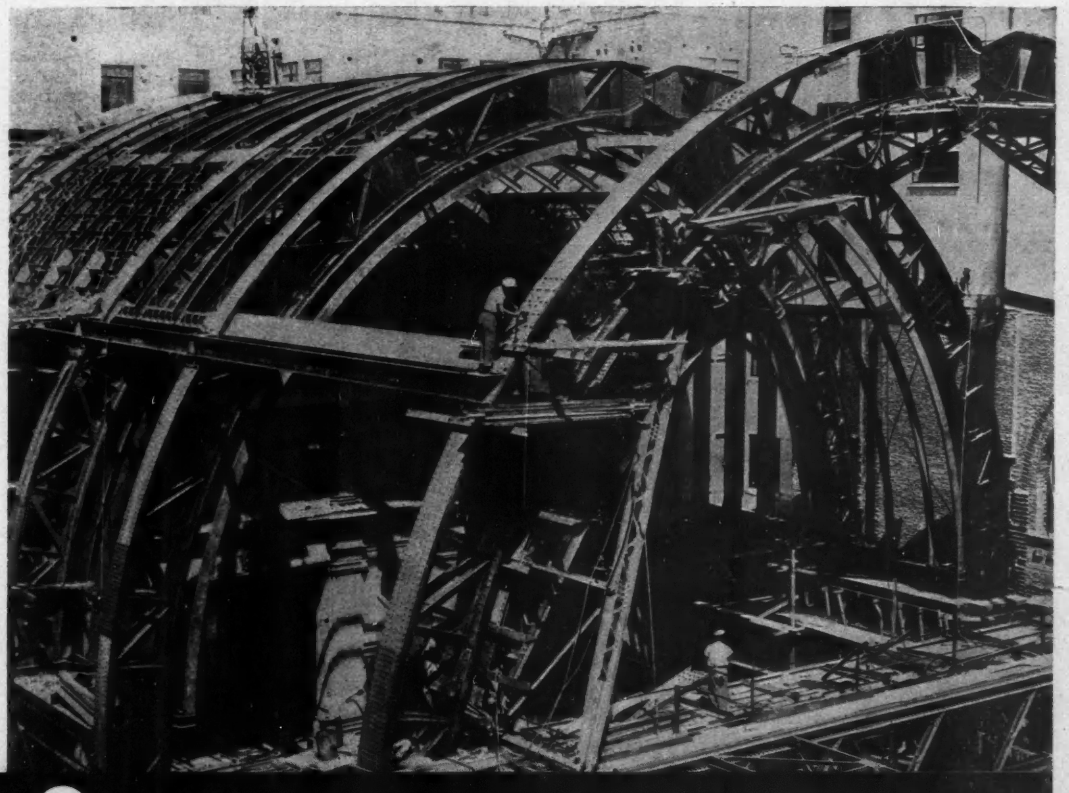

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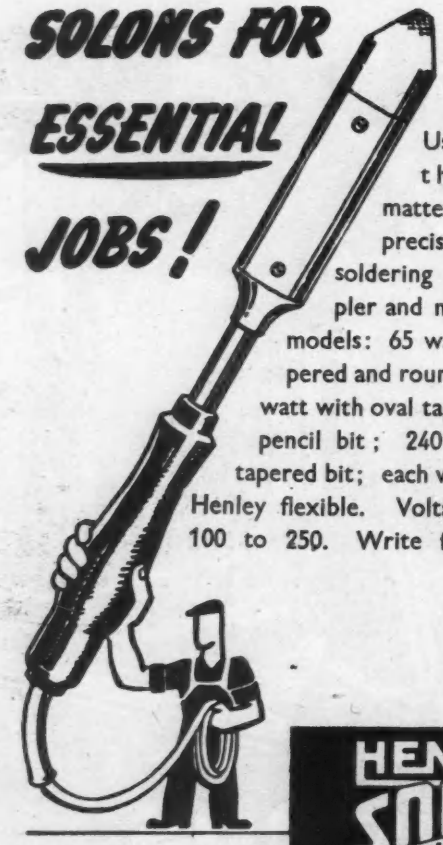

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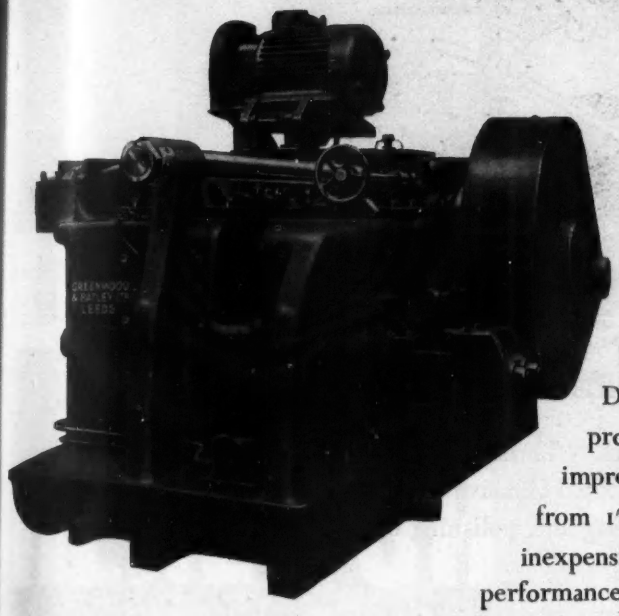

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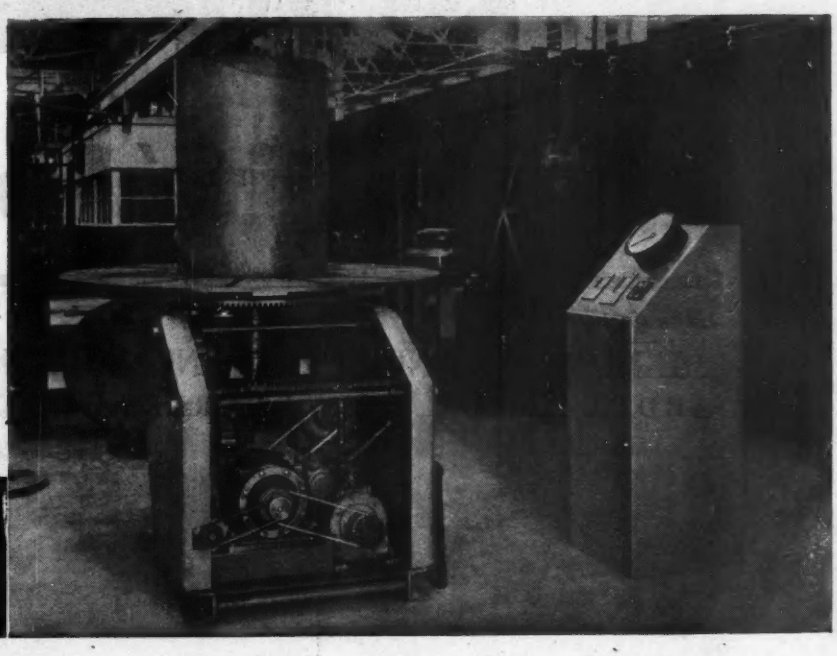

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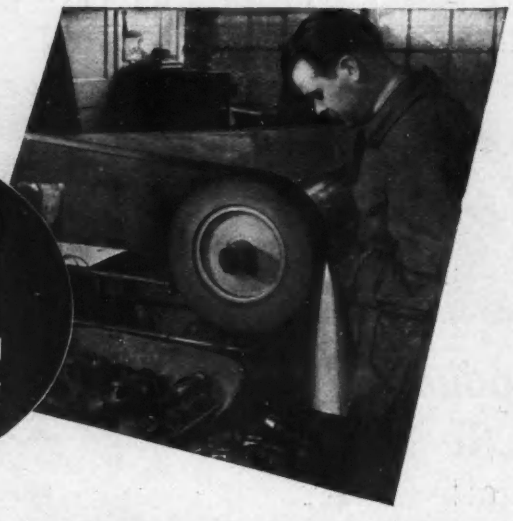

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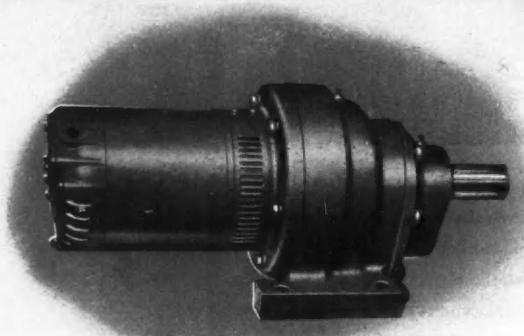

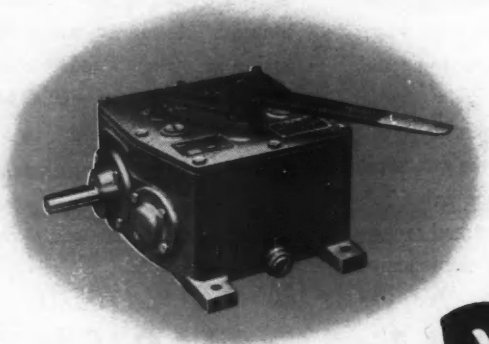

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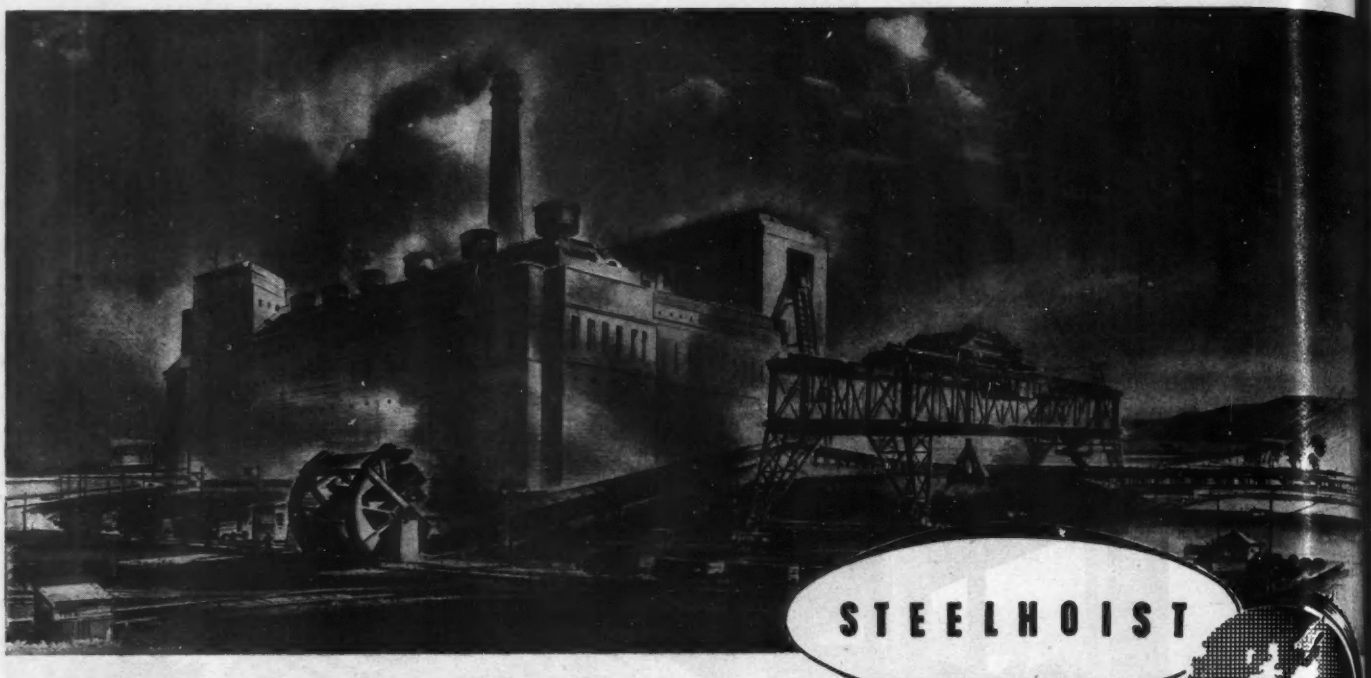

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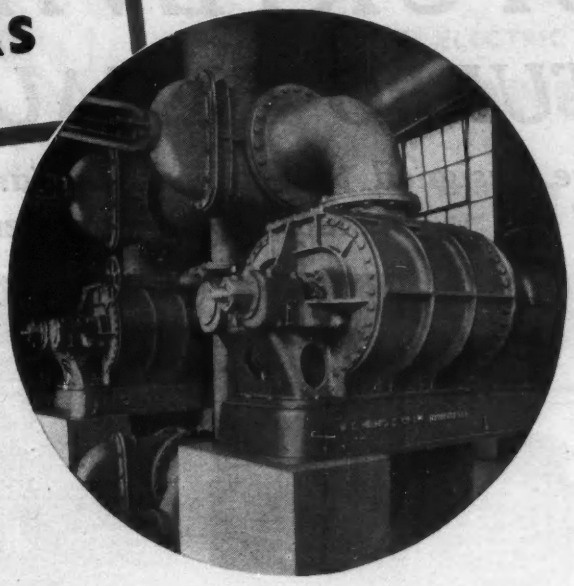

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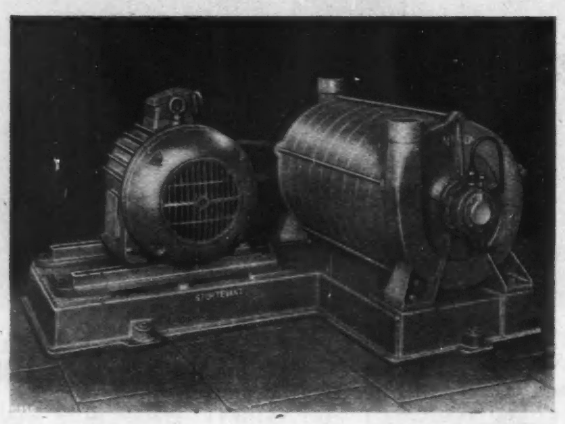

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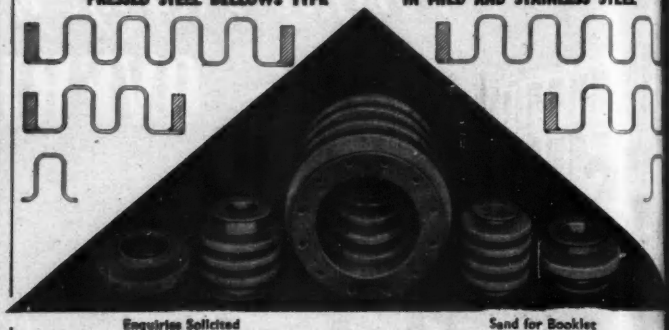

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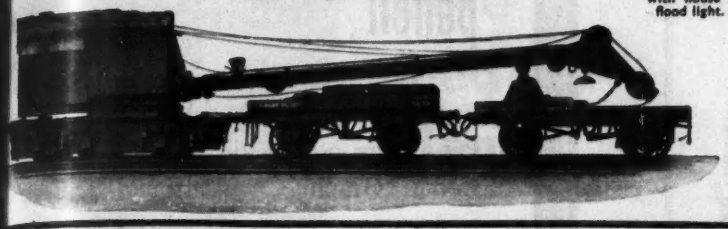

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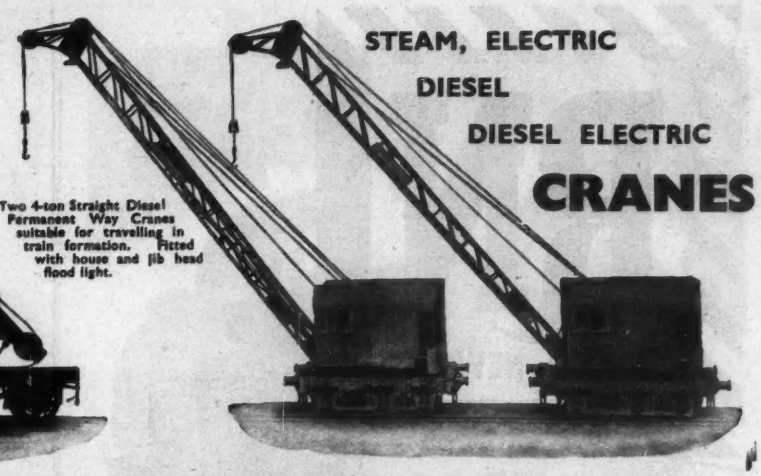

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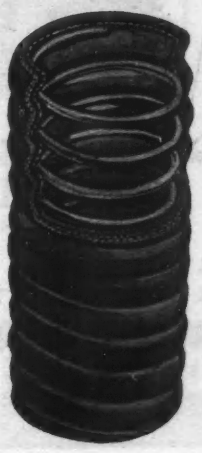

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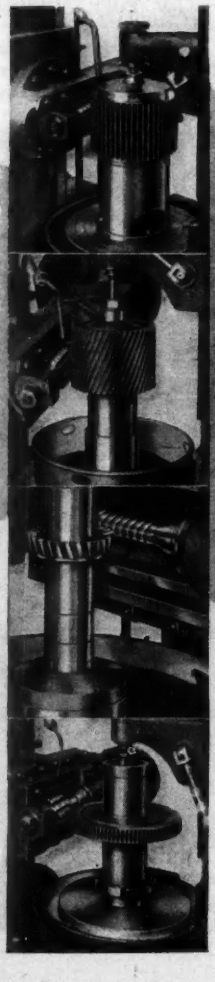

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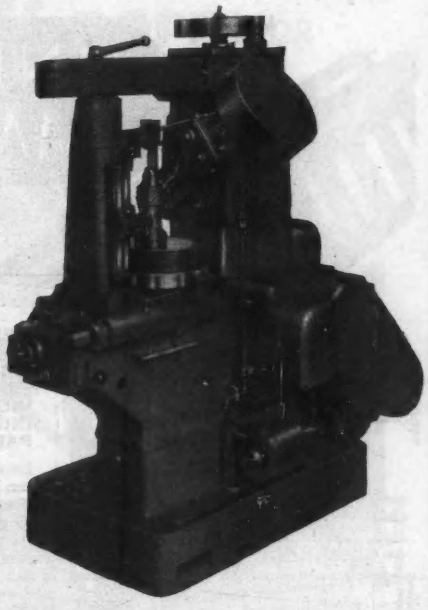

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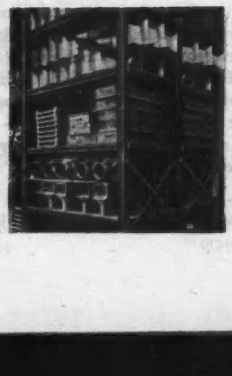

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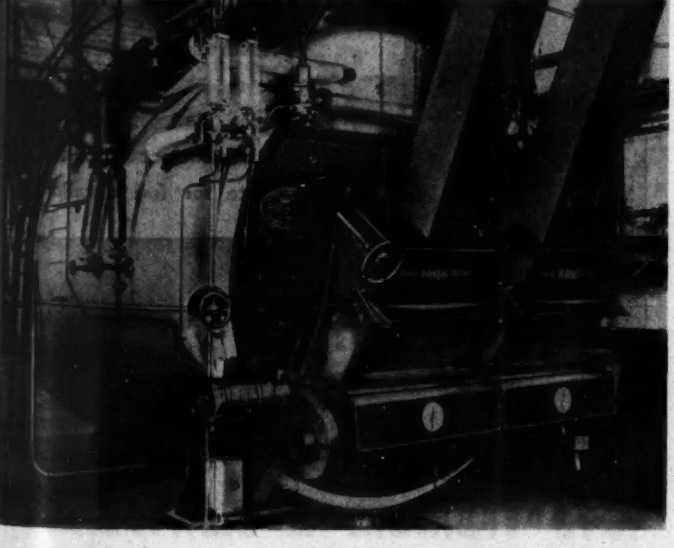

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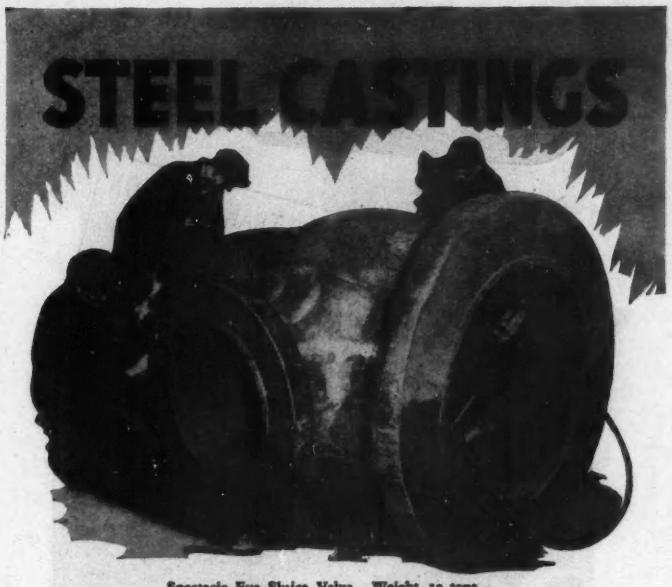

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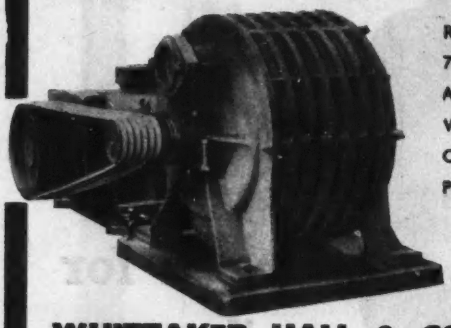

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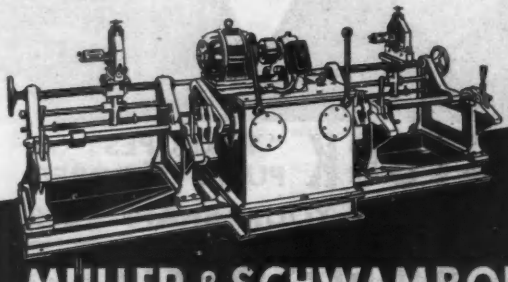

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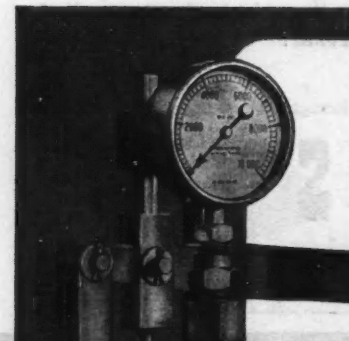

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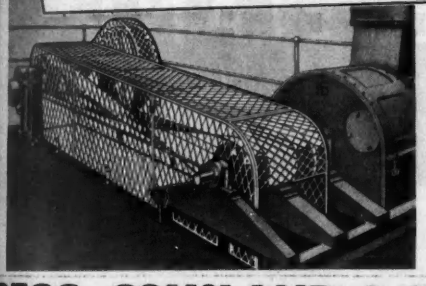

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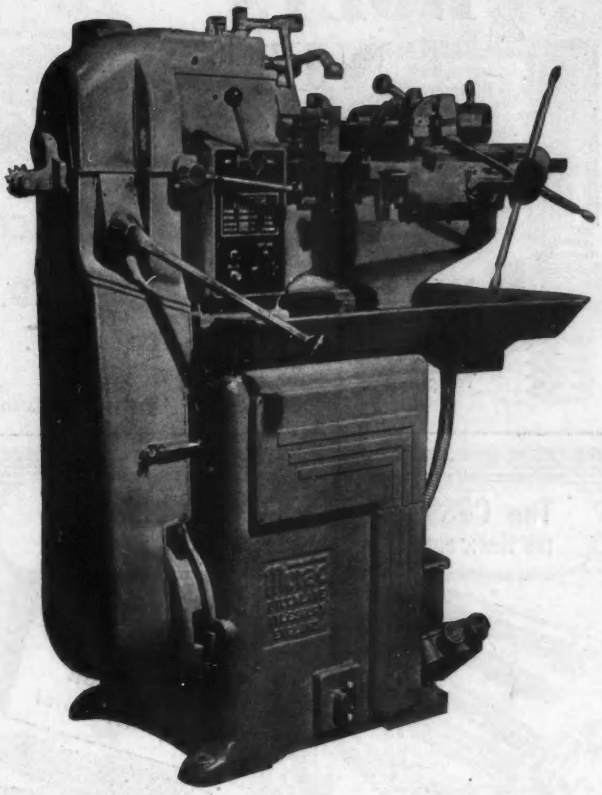

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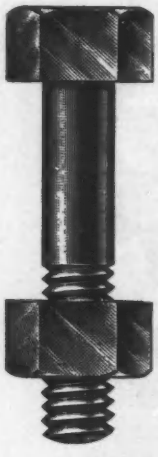

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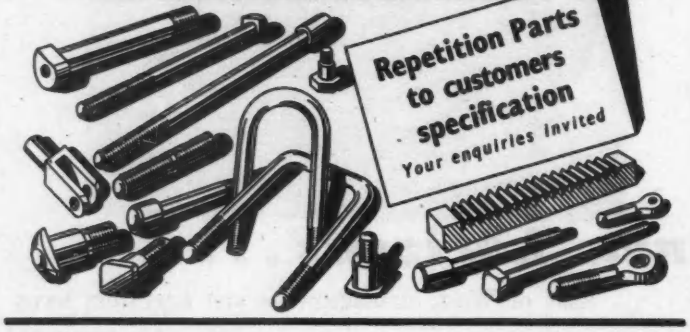

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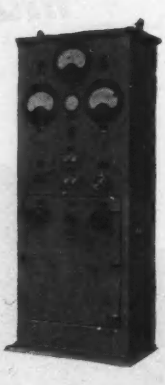

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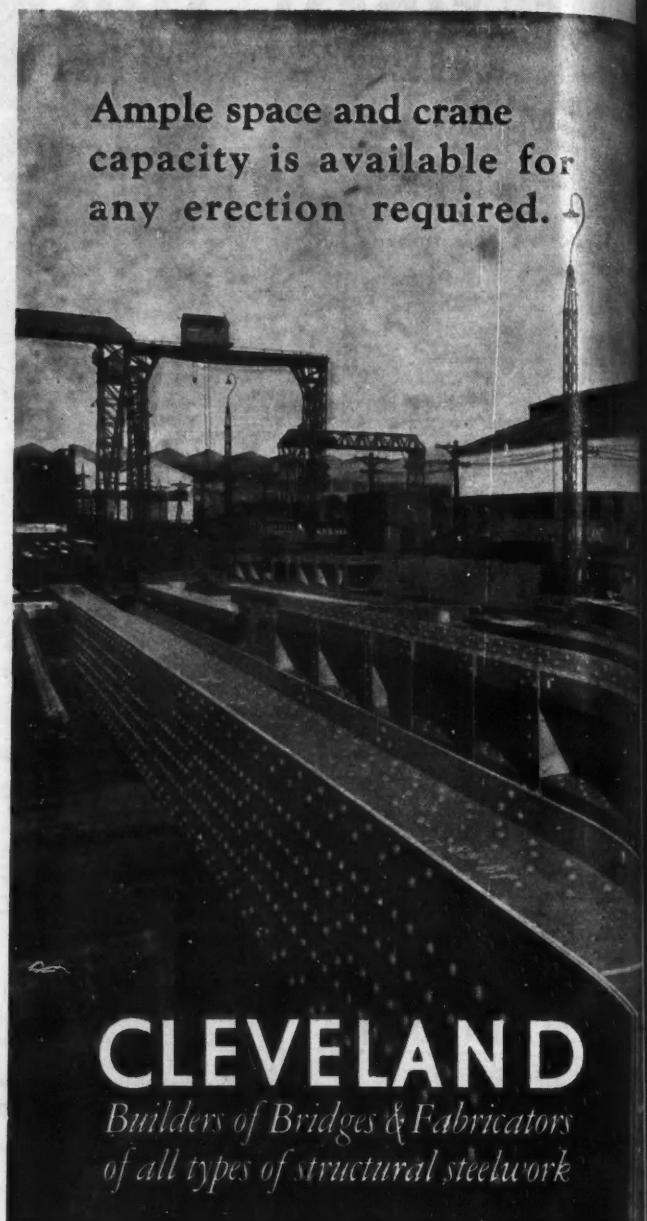

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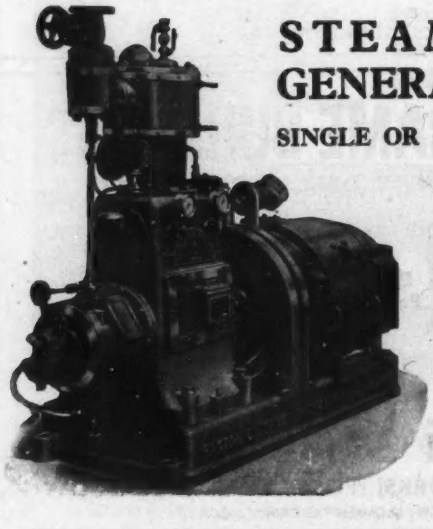

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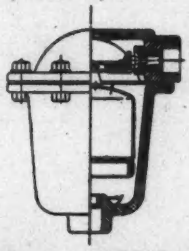
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FOR SALE

3000-ton, 6-daylight Hydraulic Board Press, by John Shaw, steam-heated platens 8ft. 6in. by 4ft. 4in., with self-contained motor-driven pumps.

2600-ton Sheeting or Belting Press, by Hydraulik, steam platens 18ft. by 7ft. 4in., with self-contained air hydraulic accumulator and pump.

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Large stock of other Hydraulic Presses, Pumps and Accumulators.

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NIAGARA 2-Deck Vibrating Screen, 80in. by 30in.; first-class order; £150.
Lightning No. 2 Crusher on stand.
25ft. centres Belt Loader, petrol engine.
Diesel Engines, 5 H.P. to 40 H.P.
Petrol Engines, 1½ H.P., 2 H.P., 3 H.P.
Electric Motors up to 50 H.P.
William R. Selwood, Limited, Chandler's Ford, Hants ('Phone, 2275). E9226 G

FOR SALE, Skip Hoist (Strachan and Henshaw), fully automatic, unused and not assembled; capacity 50 tons per hour.
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AIR COMPRESSORS, Stationary or Portable, fully automatic or petrol driven. Pneumatic tools and spraying equipment. Manufactured and fully guaranteed by Romac Industries, Limited, Department 4, The Hyde, Hendon, London, N.W.9. Telephone: Colindale 6055. E109 G

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METERS, A.C. AND D.C., new and reconditioned, all types. Quarterly, single and three-phase, 3 and 4-wire, 2½ to 1000 amps.; prepayment, single and double tariff, single, dual and triple coin, fixed and variable tariff, 2½ to 50 amps.; M.D.I., Billiard Switches, Rent Collectors. Prices from 5s., carriage paid. Guaranteed for ever. Immediate delivery.—Illustrated catalogue from The Electric Meter Company, Castor Road, Brixham. E3643 G

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(1) Either all-electric D.C., 480/500 volts, or
(2) Diesel-electric driven, or
(3) Diesel mechanical driven.
Details and price to the United Steel Companies, Limited, Workington Iron and Steel Branch, Moss Bay, Workington, Cumberland. E3837 G

OUTDOOR LABELS that last for years, easily marked for temporary or permanent use. Ideal for storage bins and outdoor notices.—Details from Woodman's, Pinner, Middx. E3703 G

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For continuation of Small Advts., page 116

FOR SALE

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RECONDITIONED MACHINERY FOR SALE.

STEAM BOILERS. — Cochran Vertical, 30 in stock, 3ft. to 8ft. 6in. dia., prompt deliveries; Economic, 4ft. to 9ft. dia., including several unused, immediate delivery; two Lancashire, 30ft. by 7ft. by 140 lb.; three 30ft. by 9ft. by 180 lb.; 300 reconditioned Vertical Cross-Tube, all sizes.

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RAILWAY MATERIAL.—Kerr 12in. by 20in., six-wheel coupled Steam Loco., 160 lb. w.p.; large stocks Rails, Points, Wagons.

ELECTRIC MOTORS.—50 H.P. Harland, T.E., S.R., 1460 r.p.m.; 35 H.P., Laurence Scott, T.E., S.C., flameproof, 990 r.p.m.

STEEL PIPING. — 10,000ft., 3in. and 6in. screwed; 10,000ft., each 2in., 4in. and 6in. Victaulic; 500 steel bends, 6in., 8in. and 10in. Flexible Pumping Hose, 4in., 8in., 10in. bore, flanged as new.

VALVES.—2000 in stock, Water, Steam, Gas; 2in. to 48in., including Hopkinson, Glenfield; all hydraulically tested.

STORAGE TANKS.—Two Lead-Lined, 35ft. long, 9ft. dia.; 200 Steel Vessels for oil, bitumen, acids; Fifty dish-ended Pressure Tanks, 8ft. 6in. by 5ft. 6in. dia.; Six Papier Mache Open Tanks, 8ft. 6in. dia., 8ft. deep, unused; Ten Earthenware Jars, acid-resisting glaze, enclosed, 500 and 2000 litres; Six O.T., 7ft. dia., 14ft. deep, lined inside with acid-resisting bricks.

Comprehensive catalogue, "Watkins Machinery Record," published monthly; free copy on request.

SLING ENGINEERING WORKS
COLEFORD, GLOS.
'Phone: Coleford 2271/2. E366 G

B.C.S.

BOILER FEED PUMPS

(1) 9000 g.p.h. Weir Vertical, Single-Cylinder Double-Acting, Boiler Feed Pump, size 9½in. by 12½in. by 24in., steam pressures up to 250 lb. p.s.i., delivery pressure up to 250 lb. p.s.i.

(2) 8000 g.p.h. Ditto, size 9in. by 12in. by 24in.

(3) 6400 g.p.h. Mather and Platt Boiler Feed Pump, driven by 45 B.H.P. Mather and Platt turbine, 250 lb. pressure, 5 lb. exhaust pressure, 3000 r.p.m., pump delivery pressure 250 lb. p.s.i. (two available).

(4) 6400 g.p.h. Ditto Pump, driven 45 B.H.P. Laurence Scott motor, 400/3/50, 2950 r.p.m., complete with Brookhirst starter (two available).

CENTRIFUGAL PUMPS

(5) 14in. suction by 12in. delivery Harland Single-Stage Centrifugal Pump, direct coupled to 340 H.P. Harland S.C. motor, 3300/3/50, 1475 r.p.m., with starter; capacity 3000/3500 g.p.m., 150ft. head at 1475 r.p.m. (two available).

(6) 14in. by 12in. Ditto Pump, direct coupled to 175 H.P. Harland motor, 3300/3/50, 980 r.p.m., capacity 3000/3500 g.p.m., 75ft. head at 980 r.p.m.

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(ENGINEERS & CONTRACTORS), Ltd.,
3, CASTLE STREET, CARDIFF.
Tel.: 29246/7/8. E8548 G

BROTHERS REED

ELECTRIC MOTORS

STANDARD A.C. SUPPLY

140 H.P. Laurence Scott Slip-Ring, 980/675 r.p.m., screen protc., ball/roller bearings with starter, &c.

75 H.P. Wright and Wood S.C., 950 r.p.m., enc. vent.

50 H.P. Brook Slip-Ring, 750 r.p.m., enc. vent., ball bearings, starter, &c.

48 H.P. L.D.M. "Maxtorq," 725 r.p.m., enc. vent. ball bearing, O.I. star/delta starter.

Two 30 H.P. L.D.M. S.C., 970 r.p.m., ball bearing.

25 H.P. Crompton-Parkinson Slip-Ring, 1150 r.p.m., ball bearing.

Many others smaller power.

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E9247 G

COMPLETE BOILER PLANT

30,000 lb. evap., 180 lb. W.P., comprising three brick set Economic boilers, 15ft. 6in. long by 9ft. 9in. dia., new 1935; clean reports; complete with superheaters, automatic stokers, feed pump, coal elevators, bunkers and steel building. Prepared separate if desired. Full details on request.

FRED WATKINS,
COLEFORD, GLOS.
'PHONE: COLEFORD 2271/2.
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Two 8-ton Diesel Capstans, by Mather and Platt, with 57 H.P. Lister, six-cylinder marine auxiliary engine, air starting. As new.

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LTD.,
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600

400/440 VOLTS D.C. ELECTRIC MOTORS

200-h.p. WESTINGHOUSE, 400/440V. D.C., 450 r.p.m., protected type 2 endshield R.O.B., with pillar type F.M. starter by Met-Vick.

87-h.p. BRUSH, 460 V. D.C., 1500 r.p.m., screen protected, compound wound, endshield B.R.B., bare shaft ext.

52-h.p. L.D.C., 400 V. D.C., 420 r.p.m., 110 amps., encl. ventilated, compound wound, shaft overhung approx. 7in., air break wall M. starter.

46-h.p. B.E.P., 440 V. D.C., 600 r.p.m., compound interpolar wound, screen protected, fan cooled, standard shaft ext.

41.75-h.p. L.D.C., 460 V. D.C., 1085 r.p.m., shunt interpolar wound, encl. ventilated, swing doors at commutator end, fan cooled, standard shaft ext., cont. rated, Verity "Aston" ironclad starter.

35-h.p. RANSOMES SIMS, 460 V. D.C., 1000 r.p.m., screen protected, encl. ventilated, shunt interpolar wound.

Two 25/30-h.p. E.C.C., 330/396 V. D.C., 1250/3000 r.p.m., 65 amps., compound interpolar, drip-proof frames, shunt field connected in series.

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SONS AND CO. LTD.
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Tel.: Shepherds Bush 2070; and
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One RUSHWORTH Single-Ended Punching Machine.
To punch ¾in. through ¾in. plate, 12in. gap.
Motorised 400/3/50 cycles supply.

One Second-Hand KREBS Horizontal Plain Milling Machine, with power feed in all directions.
Motorised 400/3/50 cycles supply.
Working surface of table 43¼in. by 11¾in.
Longitudinal traverse of table 26in.
Eight spindle speeds.
6¼in. SIMPLEX S.S. and S.C. Lathe, motorised 400-440/3/50 cycles, to admit 3ft. 6in. between centres, swing 1ft. 8in. in gap.

14in. V.D.F. S. and S. All-Geared Head Lathe, to admit 6ft. 9in. between centres, 3¼in. hollow spindle.
Travelling spindle and vernier rules.
2¾in. diameter spindle.
Travel of boring spindle in one setting plus additional travel minus 24in. plus 12in.
Maximum distance between face-plate and stay 79in.

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OLD TOWN DOCK,
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Tel., Newport 3944 (3 lines). E448 G

FOR DISPOSAL

Two Alfred Herbert No. 18 Atritors, each with A.C. motors, by Crompton Parkinson, Ellison switchgear, complete with cyclones, 15ft. by 8ft. dia., hot air coke stove, motorised primary air fans, and pulverised material feeders.

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One 15in. wide Drag Link Scraper Conveyor, 83ft. long, complete with 5 H.P. motor and starter.

Two 5in. Vertical Redler Elevators, 59ft. 6in. centres, each complete with motor, starter and worm reduction gearbox.

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One Ditto, 12ft. 6in. by 8ft. by 14ft. deep.

Three 23in. centres Underdriven Worm Reduction Gears, by Northern Manufacturing Co., 7in. output shaft, rated at 100 H.P. at 1000 r.p.m. input speed, ratio of reduction 20 : 1.

Two Broadbent 5-ton size Railway Siding Haulage Capstans, each with 30 H.P. A.C. motor, 400 volts, three-phase, 50 cycles.

Six Double Worm Reduction Gears, by Turbine Gears, ratio 587 : 1, diameter of output shaft 4¼in.

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25-TON OPEN-FRONT PRESS, inclinable "Bliss" No. 21, stroke adjustment ¾in. to 3in., adjustment on slide 2in., belt drive, excellent condition.

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130 MJ, 1in.
300 LJ, ¾in.
40 LJ, ½in.
67 HJ, 30.
67 HJ, 45.
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16 NMJ, ½in.
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Many other sizes in stock.

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EDGWICK 18in. Plain Horizontal Millers, motor drive, working surface of table 26½in. by 7½in., longitudinal power feed of table 18in., cross feed of table 6in., vertical feed of table 10½in., maximum distance centre of spindle to top of table 9¾in.

RICHMOND type 03 Universal Milling Machines, motor drive, table 30in. by 10in., complete with dividing heads, vertical milling attachment, slotting attachment, &c.

PALLAS type V1 motorised Vertical Milling Machines, working surface of table 30in. by 8½in., power longitudinal movement of table 18in., hand cross movement of table 6½in., hand vertical movement of table 14in., vertical adjustment of spindle head 2½in., maximum distance centre of spindle to face of column 9in., maximum distance spindle to table 16½in.

DENBIGH Horizontal Millers, motor drive, fitted swivelling table 10in. by 46in.

PALLAS type H00 Horizontal Production Millers, table 18in. by 6in., arranged motor drive.

WEATHERLEY Oilgear Hydraulic Vertical Broaching Machine, 20-ton capacity, 36in. stroke.

FELLOWS No. 6 Vertical Gear Shaping Machines, 36in. capacity, motor drive, complete with gear wheels.

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OFFER FOR IMMEDIATE SALE:—

One 5-Ton Butters Electric Derrick Crane with 80ft. jib.

One 5-Ton Booth Shunting Crane, 27ft. 6in. jib, 120 lb. boiler, 4ft. 8½in. gauge, new 1945.

One 5-Ton "Coles" Lorry Mounted Petrol-Electric Crane, Series VII, Mark II, 26ft. 6in. jib, completely overhauled.

One 43 B.B. Diesel Excavator, C/W 55ft., D/L with 1½ yard bucket, and F/S with 1½ yard bucket, completely reconditioned with guarantee.

One Ransome and Rapier 423 Diesel Excavator, new 1945, C/W, crane jib and B/A eqps.

One Priestman "Tiger" ½ cu. yd. Excavator, new 1944, with D/L eqp.

One Ingersoll-Rand H.K.315 Compressor, 315 cu. ft. capacity, new Sept., 1950, steel wheels.

Two Alley and MacLellan type 45 A.S.C., size No. 5, Steam Compressors, 340 cu. ft. capacity at 10 lb./in., or 284 cu. ft. capacity at 40 lb/in.

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GENERATING PLANT

750kVA Modern Steam Generating Plant. Belliss Morcom vertical engine, direct connected Laurence Scott alternator, 440 volts, three-phase, 50 cycles, speed 300 r.p.m., working pressure 120/150 p.s.i., back pressure 2 p.s.i. Plant new 1936.

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Vertical, 60in. by 20in., 100 p.s.i. £25.
Horizontal, 60in. by 20in., with feet and platform. £30.
Horizontal, 33in. by 14in., with lugs, 100 p.s.i. £14.
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Vertical, 24in. by 12in. £12.

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CORDWALLIS ESTATE, MAIDENHEAD.
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EX. DESCALING EQUIPMENT

One air-loaded Hydraulic Accumulator, comprising one water and three air bottles, water capacity 200 gallons, pressure 1300 lb. per square inch, complete with control gear, valves and pipes.

New 1948 and unused.

BOX No. E3833, "The Engineer." G

IMMEDIATELY AVAILABLE

400-kW. Diesel Alternator Set, comprising 576 h.p. Petter Superscavenge 6-cyl. engine, direct-coupled Brush alternator, output 400/3/50, speed 600 r.p.m., complete with all auxiliary and ancillary equipment, comprising alternator control panel with AVR. Heenan and Froude water cooler, air starting equipment, piping, tanks for fuel and lubricating oil, &c. All new 1948; used two years only.

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Two 8kW, unused Lister Diesel Electric Sets, each complete with 44-cell Nife nickel cadmium battery, 380 amp.-hour capacity.

Propeller Shafts, ex R.A.F. launches in K. Monel, four 1¾in. dia. by 13ft. 7in. long, and three 1¾in. dia. by 9ft. 4in. long.

Alternators up to 40kVA, all voltages, single and three-phase. Over 100 machines in stock. Twelve months' guarantee. A.V.R.s and switchboards available.

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(1) 600kW. Diesel Generator Set, ... 1000 B.H.P. vertical, 6-cylinder, solid-... two-cycle, water-cooled, compressed-... Sulzer diesel engine, 375 r.p.m., flexibly ... 600kW. Metropolitan-Vickers 440/220-... compound wound generator, complete with ... board, air starting equipment, cooling sys... tanks, exhaust system, spares, &c. (two a...

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Two 30′ × 8′.	One 15′ × 5′ 3″.
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One 12′ × 4′ 6″ × 3′ 6″.	One 5′ 6″ × 5′ × ...
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TWO NEW ARMSTRONG-WHITW... D.130, diesel-engine-driven, Perkins Pla... stage portable, mounted on pneumatics.

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Second-hand Main Line Crane, by ... Russell, all motions by steam, vertical ... insure for 100 lb. per square inch working ... fitted with steel undercarriage and steel ... 35ft. long, to lift 5 tons at 17ft. radius free ... positions.

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240 H.P. Fielding and Platt Horiz... Two-Cylinder Diesel Oil Engine, 200 r.p.m.
84 H.P. Robey Horizontal, Two-Cyl... Diesel Oil Engine, 270 r.p.m.
First-class engines.
Immediately available.

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BOILERS

One Spencer Hopwood Vertical Boiler, ... 11ft. 8½in. high, 6ft. 6in. diameter, working ... 25 lb. tested to 100 lb. per square inch.

One Cochran Vertical Boiler, No. 7646, ... pressure 25 lb., tested to 100 lb. per square ... with feed pump and make-up tank.

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CLIFF WORKS, BURTON-ON-THE-W...
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MOBILE CRANES

5-ton Rapier Pet./Elec., non-slewing.
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5-ton Coles, lorry mounted.
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FOR SALE

D & M
DYNAMO & MOTOR REPAIRS LTD

C. THREE-PHASE MOTORS

P. Motor, 1500 r.p.m., synchronous induc-
by English Electric, 3.3kV., with oil
d liquid rotor starter.
P., 980 r.p.m., Crompton Parkinson, Slip-
or, 6.6kV.
P., 222 r.p.m., Sandycroft Slip-Ring
volts, three-bearing type, with Erskine
t switch and liquid rotor starter. Two

P., 323 r.p.m., Crompton Slip-Ring Motor,
pedestals on bed, 3.3kV.
, 1000 r.p.m., Auto-Synchronous Motor,
C., 200kVA., 0.31 leading power factor,
three-phase, 50 cycles, with Brookhirst
e control panel; can be adapted for
1000 r.p.m., 182kVA., 0.8 leading power
15 volts, three-phase, 50 cycles.
P., 1000 r.p.m., Auto-Synchronous Motor,
ariane Engineering, 130kVA., 0.65 leading
tor, 400 volts, three-phase, 50 cycles, with
ontrol gear. Available one month.
P., 730 r.p.m., Slip-Ring, E.C.C., Motor,
end-plate, ring-oiled bearings, new stator
for 400/440 volts, three-phase, 50 cycles.
e in three months.

D.C. MOTORS

H.P., 300 r.p.m., compound interpole
Electric Motor, with three pedestals on
0 volts, complete with Brookhirst floor
arter.
P., 330 r.p.m., compound interpole, drip-
otors, by Metropolitan-Vickers, 220 volts.
ailable.

D.C. GENERATORS

W., 375 r.p.m., 500/250 volts, three-wire
s, by Laurence Scott, compound interpole
gle pedestal half-coupling, static balancer,
s. Two available.
W., 1250 r.p.m., compound interpole, drip-
pe, G.E.C. Generator, 225/230 volts, single
ing and half-coupling.
W. G.E.C. Generator, otherwise similar to
e. Two available.
W., 1000 r.p.m., compound interpole
tor, by Crompton, 440 volts, endplate

W., 300 r.p.m., compound interpole Gener-
Bull Motors, 220 volts, two pedestals on
e.
W., 500 r.p.m., drip-proof, shunt interpole
or, by Mawdsley, 225 volts, single ball
and half-coupling.

MOTOR GENERATOR SETS

W., 220 volts output, D.C., 730 r.p.m.,
upled slip-ring motor, all by E.C.C., now
-phase supply; can be rewound as required.
W., 440 volts D.C. output, with synchronous
n motor, 750 r.p.m., all by Crompton, now
for two-phase supply; can be rewound as

W. Frequency Changer, by E.C.C., input
e, three-phase, 25 cycles, output 440 volts,
ase, 50 cycles, 750 r.p.m., with control

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LTD.,
WEMBLEY PARK WORKS,
NORTH END ROAD,
WEMBLEY, MIDDLESEX.
Telephone: Wembley 3121. E9464 G

SERVICE EDWARDS VALUE

CO" Power Double-geared Horizontal
Metal Baling Press, balanced drive, capa-
30 lb. to 60 lb., size of bale 14½in. by 12in.
4½in., counterbalanced lid opens automatic-
when unlatched, hand clutch. Weight
t 32 cwt.
RAL HOLMAN No. 2 size Lightning Electric
atless Shearing Machines, to cut up to
uge thick universal, 220/250 volts.
MS" SQE 120 Auto. Irregular Double
ing Machine, Squeezer type, capacity up
10½in. square or equivalent overhead
pable mandrel, treadle clutch. Weight
t 30 cwt.
R Irregular Squeezing Machine, capacity
15in. across corners, treadle clutch.
R Squeezing Machine, capacity to 10in. by
, treadle clutch. Weight about 11 cwt.
OR and CHALLEN No. 3 Size 10 Heavy
ble-Sided Hand Wheel Screw Press, between
hts 15in., size of bed 8½in., dia. of screw
dia. of hand wheel 60in. Weight 28 cwt.
RIAL Gold Blocking Press, double-sided,
gas-heated top platen, 9in. by 5in., bottom
n 12½in. by 10in., hand lever operated.
AL Hand Lever Presses, designed to put oil
ves in sn-all bearings, &c., two grooving
dles and revolving jig table.
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E209 G

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14ft. 8in. by 8ft. 6in. diam., welded constr.,
by 16in. manhole and cover, W.P. 75 lb.;
approx. 4½ tons each. Suitable vert. or
mounting.
ne 14ft. 8in. by 8ft. 1in. diam., riveted
., 10½in. by 15½in. manhole and cover, W.P.
weight approx. 4½ tons each.
10ft. 6in. by 10ft. diam., and another 11ft.
ft. diam., riveted constr., 18in. diam. manhole
ver, W.P. 40/50 lb.
rge Cohen, Sons and Co., Ltd., Wood Lane,
on, W.12: Tel., Shepherds Bush 2070; and
ingley, Nr. Leeds; Tel., Pudsey 2241.
E9410 G

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PUMP UNITS

NEW ELECTRICALLY DRIVEN
MEDIUM HEAD
CENTRIFUGAL PUMPING SETS

50 GPM/115ft. hd., 1¼in. Two-Stage Pump, by Pulsometer, type HSRB 1¼, d/c on bed-plate to 5 H.P. S.C. motor, 1450 r.p.m., 400/440-3-50 or 500/550-3-50.

100 GPM/200ft. hd., 2in Two-Stage Pump, by Pulsometer, type HSRA 2, d/c on bed-plate to 15 H.P. S.C. motor, 2900 r.p.m., 400/440 or 500/550-3-50.

200 GPM/190ft. hd., 3in. Two-Stage Pump, by Pulsometer, type HSRB 3, d/c on bed-plate to 20 H.P. S.C. motor, 1450 r.p.m., 400/440 or 500/550-3-50.

400 GPM/150ft. hd., 4in. Single-Stage Pump, by Pulsometer, type LEX 4, d/c on bed-plate to 30 H.P. S.C. motor, 1450 r.p.m., 400/440 or 500/550-3-50.

500 GPM/130ft. hd., 4in. Single-Stage Pump, by Harland, type SDC 4/5, d/c on bed-plate to 30 H.P. S.C. motor, 1450 r.p.m., 400/440 or 500/550-3-50.

600 GPM/160ft. hd., 5in. Single-Stage Pump, by Harland, type SDC 5/6, d/c on bed-plate to 45 H.P. S.C. motor, 1450 r.p.m., 400/440 or 500/550-3-50.

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SUBMERSIBLE
PUMPING SETS

30 GPM/210ft. hd., RS-BERRYHILL type 6108 1¼in. Submersible Motor Pump, with 4 H.P. motor, 2800 r.p.m., 400/440-3-50. Max. diam. 5¼in. for 6in. borehole.

60 GPM/380ft. hd., RS-BERRYHILL type 6106, 2¼in. Submersible Motor Pump, with 12½ H.P. motor, 2900 r.p.m., 400/440 or 500/550-3-50. Max. diam. 7¼in. for 8in. borehole.

120 GPM/500ft. hd., RS-BERRYHILL type 6108, 3in. Submersible Motor Pump, with 30 H.P. motor, 2900 r.p.m., 400/440 or 500/550-3-50. Max. diam. 8in. for 9in. borehole.

240 GPM/860ft. hd., RS-BERRYHILL type 6110 4in. Submersible Motor Pump, with 40 H.P. motor, 2900 r.p.m. 400/440 or 500/550-3-50. Max. diam. 10¼in. for 12in. borehole.

480 GPM/300ft. hd., RS-BERRYHILL type 6112 5in. Submersible Motor Pump, with 75 H.P. motor, 2900 r.p.m., 400/440 or 500/550-3-50. Max. diam. 11in. for 14in. borehole.

960 GPM/255ft. hd., RS-BERRYHILL type 6115, 6in. Submersible Motor Pump, with 135 H.P. motor, 2900 r.p.m., 400/440 or 500/550-3-50. Max. diam. 13½in. for 16in. borehole.

TELEPHONE
CHEADLE 2181 & 2261.

These units are random items from our large stock. If your requirements are not covered above, please contact us.

BERRY HILL PLANT DIVISION,
CHEADLE, STAFFS.
B108 G

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250 c. ft., four-tool Worthington Simpson Air Compressor, fitted International diesel engine; overhauled. £350.

1200 c. ft. Broom Wade four-cylinder Stationary Air Compressor, on bed-plate, with reduction gear, and half-coupling; needs minor overhaul. Weight 8 tons. £250.

Priestman "Tiger" Excavator, fitted 50ft. dragline, and Dorman 2DS diesel engine; good order. £950.

Pegson 16in. by 9in. Portable Stone Crusher, fitted Ruston Hornsby diesel engine and revolving screen; overhauled. £750.

Cletrac type DDH, Crawler Tractor, fitted six-cylinder Hercules diesel engine and double-drum winch; overhauled, less dozer. £750.

Fowler 10/7 Portable Concrete Mixer, fitted Marshall petrol engine; new, in makers' crates. £295.

2½-ton Morris Versatile Mobile Crane, fitted Perkins P4 diesel engine; good order. £650.

2-ton, 35ft. span Wharton O.H.T. Crane, hand power throughout; excellent condition. £225.

5/7-ton, 42ft. span Holt and Willets O.H. Electric Travelling Crane, cab control, twin lattice bridge girders, motorised 400/3/50; good order. £950.

25kVA., 400/3/50, four-wire Metro-Vick., 1500 r.p.m. Alternator, with switchboard; overhauled. £310.

250kW., 205 V. D.C. Ruston Hornsby Diesel Set, 250 r.p.m., 388 H.P., type 4VK engine; good condition. Weight 30 tons. £1650.

190kVA., 400/3/50, four-wire Dusts/A.E.G. Diesel Alternator, cylinder block needs renewing. Offered at price of alternator, £1200.

58kVA., 400/3/50, Fowler/L.D.D.C. Diesel Alternator, complete with radiator, switchboard, electric start, &c., self-contained on bed-plate; overhauled. £1650.

50kW., 230 V. D.C., Gardner/E.C.C. Diesel Set, on bed-plate, suitable marine use; overhauled. £950.

27½kVA., 400/3/50, Hills self-contained Diesel Alternator, on bed-plate, electric start; good order. £550.

20kVA., 400/3/50, four-wire Lister/Maudsley self-contained diesel alternator, on bed-plate; unused. £695.

15kVA., 230/1/50, Lister/C.P., self-contained Diesel Alternator, on bed-plate; overhauled. £495.

22 H.P. at 600 r.p.m. Blackstone, single-cylinder, horizontal Diesel Engine. £295.

45 H.P. at 240 r.p.m. Ruston Proctor, single-cylinder, horizontal Diesel Engine. £390.

22 H.P. at 750 r.p.m., C.P.T. six-cylinder, vertical Diesel Engine, suitable marine or stationary use. Price on application.

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VERTICAL BORING MILL

Multi-motor drive, with two swivel tool heads on cross rail.
Table diameter 88½in., max. swing 98½in., height above table 59in.

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E210 G

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WATER-TUBE BOILERS

(1) 25,000 lb. per hour Babcock and Wilcox Single-Drum, Land type Marine Water-Tube Boiler, new 1925, 200 lb. working pressure, 570 deg. F. temperature, complete with superheater, Green's economiser, forced draught fan, twin chain grate stokers, soot blowers, steelwork, valves, fittings, gauges, &c.

(2) 15,000 lb. per hour Boiler, as above, new 1921, complete with Green's economiser, superheater, chain grate stoker, soot blowers, steelwork, valves, gauges, fittings, &c.

(3) 10,000 lb. per hour Babcock and Wilcox, Single-Drum, Water-Tube Boiler, new 1930, 160 lb. working pressure, heating surface 2255 sq. feet, complete with all fittings.

B.C.S.
(ENGINEERS & CONTRACTORS), Ltd.,
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Tel.: 29246/7/8. E8843 G

MEADOWS Pet. Elec. Gen. Set, 7.5kVA. 400/40V., 3-ph., aut. volt. reg., rad. cooled. New cond. with sw. gear and instr.—BOX No. E3836, "The Engineer." G

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600
HYDRAULIC PRESSES

Several 1160-ton Upstroke Presses by Robertson and Orchar, glanded rams 33¾in. diam. by 8in. stroke, 4 steel columns 8in. diam. daylight table to head 16in., fitted steam platens 6ft. 5in. by 4ft., 3000 lb W.P.

1000-ton Downstroke Piercing and Forging Press, ram 25½in. diam. by 6ft. stroke, 4 columns 9¼in. diam., distance between 6ft. 2¼in. by 2ft. 8¾in., daylight 14ft., accumulator and pumping equipt. available.

600-ton Upstroke by JOHN SHAW, rams 19in. diam. by 4ft. stroke, working surface press head 97in. by 88in., two independent moving tables, each 60in. by 48in., daylight 40in.

400-ton Downstroke by GREENWOOD & BATLEY, ram 16in. diam. by 28in. stroke, fully guided moving table 34in. by 22¾in., daylight 40in., Prefil valve and tank, W.P. 2 tons sq. in.

250-ton Upstroke Press, ram 18in. diam. by 15in. stroke, semi-guided tee-slotted table, working area 30in. by 14in., daylight 14¼in., 4 columns 5¼in. diam., W.P. 1 ton.

180-ton Upstroke by Hydraulic Engineering Co., ram 10¼in. diam. by approx. 2ft. stroke, fully guided moving table working area 3ft. by 2ft. 6in., daylight 16¼in., W.P. 5000 lb.

200-ton Downstroke by Tangye, ram 12in. diam. by 24in. stroke, 4 columns 5¼in. diam., fixed and fully guided moving tables tee slotted, working area 2ft. 6in. by 2ft. 6in., daylight 3ft., main ram and moving table returned by two 3in. diam. pushback rams, arranged prefilling, complete with Towler Electraulic pumping equipt. and control valves.

120-ton Downstroke Press by Finney, ram 12in. diam. by 18in. stroke, fully guided table 20in. by 20in., tee slotted, two 2¼in. diam. pushback rams, daylight 33in., arranged prefilling, W.P. 1 ton.

60-ton Horiz. Wheel Forcing Press, ram 8¼in. diam. by 12in. stroke, manual return distance between tie bars 38¾in., distance for cradle to ram head 6ft. 6in., complete with hand-operated pump.

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SONS AND CO. LTD.
WOOD LANE, LONDON, W.12.
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B.C.S.

DIESEL ENGINES

1250 B.H.P. Vertical, 6-Cylinder, Solid-Injection, 2-Cycle, Single-Acting, Super-Scavenge Diesel Engine, by Sulzer, 420 r.p.m., complete with air starting equipment, water-cooling tower and softening plant, exhaust system, fuel tanks, valves, piping, gauges, tools and spares.

Installed by Sulzer Bros. in 1948 (two available).

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(ENGINEERS & CONTRACTORS), Ltd.,
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Excellent 250-kVA., 200-kW. Bellias and Morcom Steam Engine-driven Alternator Set, vert., compound, steam 140/160 p.s.i., 12/15 p.s.i. back pressure, for oil-free exhaust; automatic expansion gear, mounted on extended base-plate direct driving alternator by Harland Engineering Co., 400/3/50, 4 wire, with switch panel; built 1932. Engine thoroughly overhauled by makers recently. Available for immediate despatch.

George Cohen, Sons and Co., Ltd., Wood Lane, London, W.12, and Stanningley, Near Leeds.
E9337 G

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J. H. Norris & Son F.A.I.
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E9428 J

For continuation of Small Advts., page 120

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Largest working horsepower of any Diesel crawler.

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OUR TECHNICAL DEPARTMENT IS ALWAYS READY TO HELP YOU

HOFFMANN

The Ball Journal

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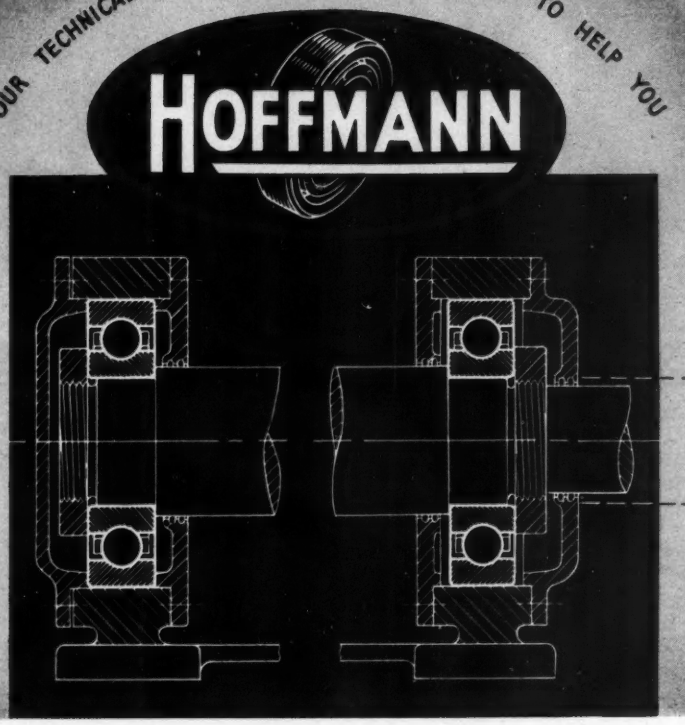

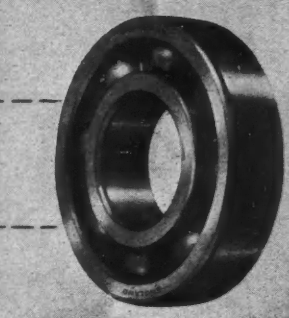

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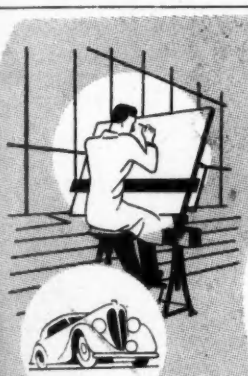

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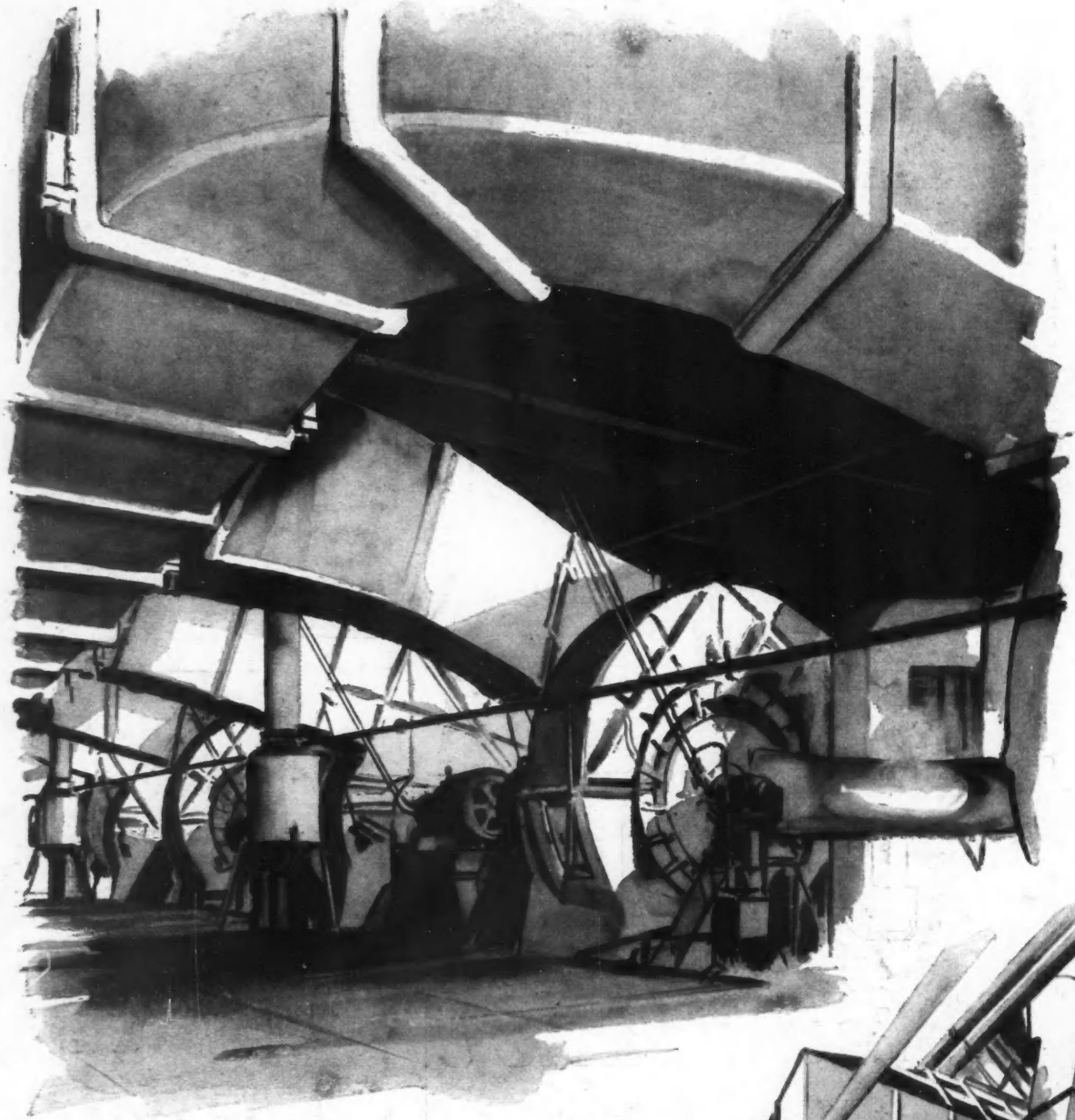
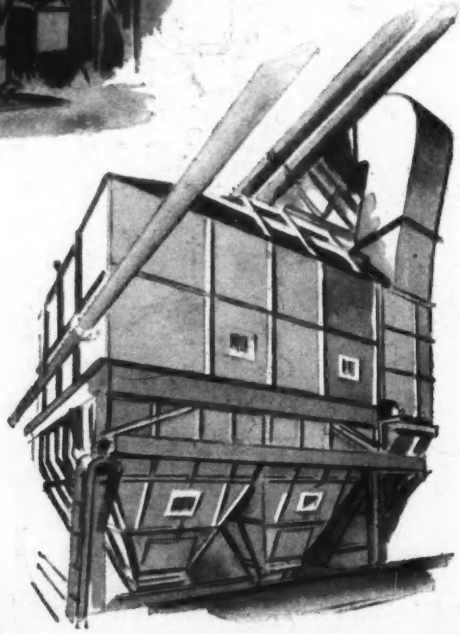
JUNE 20, 1952





Howden induced draught fans with scroll collectors, at a south coast generating station
Below: Howden Centicell dust collectors at a London Power Station.

HOWDEN

JAMES HOWDEN & COMPANY LIMITED, 195 SCOTLAND STREET, GLASGOW, C.5, and 15 GROSVENOR PLACE, LONDON S.W.1